Oral Health Surveys

Basic Methods

4th Edition

World Health Organization
Geneva

Basic oral health surveys provide a sound basis for estimating the present oral health status of a population and its future needs for oral health care, and for monitoring changes in the levels and patterns of oral diseases and conditions. The methods described in the previous editions of this manual have been used by more than 130 health administrations in conducting oral health surveys. This new edition, which presents an updated version of the WHO Oral Health Assessment Form, takes account of the experience gained in these surveys, as well as of recent developments in oral health care and epidemiological techniques. In particular, new sections on the evaluation of extra-oral conditions, the oral mucosa, enamel opacities/hypoplasia, loss of periodontal attachment and dentofacial anomalies are included, in order to provide a more complete assessment of oral health.

This manual should be of practical use to all those involved in oral epidemiology and oral health care planning.

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The Organization seeks through its publications to support national health strategies and address the most pressing public health concerns of populations around the world. To respond to the needs of Member States at all levels of development, WHO publishes practical manuals, handbooks and training material for specific categories of health workers; internationally applicable guidelines and standards; reviews and analyses of health policies, programmes and research; and state-of-the-art consensus reports that offer technical advice and recommendations for decision-makers. These books are closely tied to the Organization's priority activities, encompassing disease prevention and control, the development of equitable health systems based on primary health care, and health promotion for individuals and communities. Progress towards better health for all also demands the global dissemination and exchange of information that draws on the knowledge and experience of all WHO's Member countries and the collaboration of world leaders in public health and the biomedical sciences.

To ensure the widest possible availability of authoritative information and guidance on health matters, WHO secures the broad international distribution of its publications and encourages their translation and adaptation. By helping to promote and protect health and prevent and control disease throughout the world, WHO's books contribute to achieving the Organization's principal objective—the attainment by all people of the highest possible level of health.

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Preface

Basic oral health surveys provide a sound basis for estimation of the present oral health status of a population and its future needs for oral health care. They produce reliable baseline data for development of national or regional oral health programmes and for planning for appropriate numbers and types of personnel for oral care.

Since the first edition of this manual was published in 1971, more than 130 health administrations have conducted oral health surveys in accordance with the recommended basic methods. These surveys have shown that dramatic changes in oral health have occurred in many populations, as a result of changes in disease trends and new treatment techniques as well as changes in age structure.

In this new edition of the manual, the basic methods have been brought up to date to include recent developments in oral care and epidemiological techniques. In particular, new sections on the evaluation of extra-oral conditions, the oral mucosa, enamel opacities/hypoplasia, loss of periodontal attachment and dentofacial anomalies have been included, in order to provide a more complete assessment of oral diseases and conditions.

Aims of the manual

The aims of this manual are:

1. To provide a systematic approach to the collection and reporting of data on oral diseases and conditions.
2. To ensure that data collected in a wide range of environments are comparable.
3. To encourage oral health administrators in all countries to make standard measurements of oral diseases and conditions as a basis for planning and evaluating oral health programmes.

To achieve these aims the manual provides:

1. Guidelines on a practical and economic sample design suitable for assessing oral diseases and treatment needs for planning and monitoring oral health services.
2. A description of diagnostic criteria that can be readily understood and applied in all countries.
3. Information on means of obtaining practical assistance for planning and implementing surveys, summarizing data and analysing results.

Chapter 1 describes general principles for designing basic oral health surveys on which both monitoring of oral disease trends and estimation of oral care needs for populations can be based; Chapter 2 gives advice on organizing and conducting a survey; Chapter 3 describes ways of ensuring that the data collected are as consistent and reliable as possible; Chapter 4 provides practical guidance on implementing the survey; Chapter 5 gives instructions on completing the standard oral health assessment forms; Chapter 6 describes the assistance that can be provided from WHO; and Chapter 7 explains how survey reports should be prepared and presented. A list of the tables that can be prepared at WHO from data collected in a basic oral health survey is given in Annex 1.

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1. Design of a Basic Oral Health Survey

Objectives

Basic oral health surveys are used to collect information about the oral health status and treatment needs of a population, and subsequently, to monitor changes in levels and patterns of disease. In this way, it is possible to assess the appropriateness and effectiveness of the services being provided and to plan or modify oral health services and training programmes as needed. Basic oral health surveys are not designed to collect information about etiological factors affecting disease distribution or severity, or about the clinical effectiveness of different preventive or care procedures. However, the information obtained using basic surveys can be used to monitor aspects of the effectiveness of oral care services.

The methods described in this manual can be used to determine:

1. The extent to which existing oral health services are coping with the current need for care.
2. The nature and extent of required preventive, curative and restorative services.
3. The resources needed to establish, maintain, expand or reduce an oral health care programme, including an estimate of the number and type of personnel required.

Surveys to determine the oral health status and treatment needs of communities and populations are an essential part of the duties of chief dental officers and other administrators responsible for oral health care services. Where there is no national or regional dental officer with specific responsibility for oral health activities, either members of the dental association, or staff of training institutions for oral care personnel, should undertake regular epidemiological surveys of oral health conditions.

Special characteristics of oral diseases

In some situations, investigators will have access to the advice of an expert in health statistics who might be able to provide guidance on planning a

survey. However, particular features of the epidemiology of oral diseases have permitted the development of an approach to sample design and survey planning for the most common oral diseases that is different from traditional sample designs. The special considerations concerning the two major oral diseases—dental caries and periodontal diseases—are as follows:

1. The diseases are strongly age-related, as there is often an increase in severity and prevalence with increased age.
2. The diseases exist in all populations, varying only in severity and prevalence.
3. One of the diseases, dental caries, is irreversible (at the cavitation level used in the methods described here) and thus information on current status provides data not only on the amount of disease present, but also on previous disease experience.
4. There is extensive documentation on variation of profiles of dental caries for population groups with different socioeconomic levels and environmental conditions.
5. Many observations are made in standard measurements for each subject, i.e. for each tooth in the case of caries and for the six sextants of the mouth in the assessment of periodontal diseases.

Other important information which needs to be collected routinely in oral health surveys is also included in the assessment. It should be noted, however, that in-depth studies of the less common oral diseases require different survey designs.

Pathfinder surveys

The special factors associated with the most common oral diseases and the extensive experience gained in oral epidemiology over the past 25 years have enabled a practical, economic survey sampling methodology to be defined, called the "pathfinder" method.

The method used is a stratified cluster sampling technique, which aims to include the most important population subgroups likely to have differing disease levels. It also proposes appropriate numbers of subjects in specific index age groups in any one location. In this way, reliable and clinically relevant information for planning is obtained at minimum expense. The method is suitable for obtaining the following information:

- The overall prevalence of the common oral diseases and conditions affecting the population.
- Variations in disease level, severity and need for treatment in

subgroups of the population. This enables groups in special need of services to be identified.

- Age profiles of oral diseases in the population to enable care needs for different age groups to be determined, to provide information about severity and progression of disease, and to give an indication as to whether the levels are increasing or decreasing.

Pathfinder surveys can be either pilot or national, depending on the number and type of sampling sites and the age groups included.

A pilot survey is one that includes only the most important subgroups in the population and only one or two index ages, usually 12 years and one other age group. Such a survey provides the minimum amount of data needed to commence planning. Additional data should then be collected in order to provide a reliable baseline for the implementation and monitoring of services.

A national pathfinder survey incorporates sufficient examination sites to cover all important subgroups of the population that may have differing disease levels or treatment needs, and at least three of the age groups or index ages (see page 7). This type of survey design is suitable for the collection of data for the planning and monitoring of services in all countries whatever the level of disease, availability of resources, or complexity of services. In a large country with many geographical and population subdivisions and a complex service structure, a larger number of sampling sites is needed. The basic principle of using index ages and standard samples in each site within a stratified approach, however, remains valid.

The following method is recommended as a general guideline for basic oral health surveys for the planning, monitoring and evaluation of oral care services.

Subgroups. The number and distribution of sampling sites depend upon the specific objectives of the study. Sampling sites are usually chosen so as to provide information on population groups likely to have different levels of oral disease. The sampling is usually based on the administrative divisions of a country—the capital city, main urban centres, and small towns and rural areas. In countries where there are different geophysical areas, it is usual to include at least one sampling site in each area type.

If there are several distinct ethnic groups in the population with known, or suspected, differences in levels of oral disease, it may be necessary to include separate samples of each of these groups in the main subdivisions for the survey. However, maximum use should be made of available knowledge about variations between the different groups in order to limit the number of additional subsamples needed. Once the

different groups are decided upon, application of random sampling of subjects within the groups is desirable.

The assistance of local health administrators can be very useful when the final decision is made as to which population subgroups are significant for the study and should be represented in the final sample. For a national pathfinder survey, between 10 and 15 sampling sites are usually sufficient. If, however, there are large urban centres in the country, it may be necessary to locate several additional sampling sites in at least two cities.

Index ages and age groups. The following ages and age groups are recommended: 5 years for primary teeth and 12, 15, 35–44 and 65–74 years for permanent teeth.

- *5 years.* Where it is practical and feasible, children should be examined between their 5th and 6th birthdays. This age is of interest in relation to levels of caries in the primary dentition which may exhibit changes over a shorter time span than the permanent dentition at other index ages. In some countries 5 years is also the age at which children begin primary school.
  Note: In countries where school entry is later, e.g. at 6 or 7 years, these ages can be used, though the mean age should be reported with the results. In these older age groups, missing primary incisor teeth should not be scored as missing because of the difficulty in differentiating between primary incisors lost due to exfoliation and those lost because of caries or trauma.
- *12 years.* This age is especially important as it is generally the age at which children leave primary school, and therefore in many countries, is the last age at which a reliable sample may be obtained easily through the school system. Also, it is likely at this age that all permanent teeth, except third molars, will have erupted. For these reasons, 12 years has been chosen as the global monitoring age for caries for international comparisons and monitoring of disease trends.

  In some countries, however, many school-age children do not attend school. In these circumstances, an attempt should be made to survey two or three groups of non-attenders, from different areas, in order to compare their oral health status with that of children attending school.
- *15 years.* At this age the permanent teeth have been exposed to the oral environment for 3–9 years. The assessment of caries prevalence is therefore often more meaningful than at 12 years of age. This age is also important for the assessment of periodontal disease indicators in adolescents. In countries where it is difficult to obtain

reliable samples of this age group, it is usual to examine 15-year-olds in two or three areas only, i.e. in the capital city or other large town, and in one rural area.

- *35–44 years (mean = 40 years).* This age group is the standard monitoring group for health conditions of adults. The full effect of dental caries, the level of severe periodontal involvement, and the general effects of care provided can be monitored using data for this age group. Sampling adult subjects is often difficult. Samples can, however, be drawn from organized groups, such as office or factory workers. Use may also be made of readily accessible groups, e.g. at a market, to obtain a reasonably representative sample in situations where truly representative sampling is not feasible. Care must be taken to avoid obvious bias, such as sampling patients at medical care facilities.
- *65–74 years (mean = 70 years).* This age group has become more important with the changes in age distribution and increases in life-span that are now occurring in all countries. Data for this group are needed both for planning appropriate care for the elderly and for monitoring the overall effects of oral care services in a population. Examination of representative members of this age group is often not as difficult as for the previous age group, as elderly people are more likely to be found in or near their homes, or in day centres or institutions, and can therefore be examined during the day. Nevertheless, care should be taken to sample adequately both house-bound and active members of this age group.

Number of subjects. The number of subjects in each index age group to be examined ranges from a minimum of 25 to 50 for each cluster or sampling site, depending on the expected prevalence and severity of oral disease.

An example of a sample design for a national pathfinder survey for each index age or age group is as follows:

Urban:	4 sites in the capital city or metropolitan area	$(4 \times 25 = 100)$
	2 sites in each of 2 large towns	$(2 \times 2 \times 25 = 100)$
Rural:	1 site in each of 4 villages in different regions	$(4 \times 25 = 100)$
Total	12 sites × 25 subjects	$= 300$

If this cluster distribution is applied to four index ages in the population under study, the total sample is $4 \times 300 = 1200$.

Such a sample design permits the identification of significant differences between urban and rural groups and, in certain situations, between different socioeconomic groups in the capital city or large towns. Areas

where the disease prevalence is either much higher or much lower than the national average may also be identified from the results of such a survey.

However, a total of 25 subjects, with approximately equal numbers of females and males, is sufficient only in populations where caries and periodontal disease levels are estimated to be low or very low. In populations where these disease levels are known to be moderate or high—e.g. the percentage of caries-free 12-year-olds is 5–10% or lower—the standard size for each sample should be 40–50 subjects.

If the level of dental caries in the population is unknown, it will be necessary to estimate the level of disease before starting a survey. A rapid and effective way of estimating the prevalence of caries in a population is by classifying a group of subjects as caries-free or not. For example, it should be possible to examine two or three classes of 12-year-olds of different socioeconomic levels, in two or three local, easily accessible schools, where the widest possible differences in disease may be expected. If more than 20% of the children in the class are caries-free, the caries prevalence is low; if 5–20% are caries-free, the prevalence is moderate; and if fewer than 5% are caries-free, the prevalence is high. This estimate of prevalence may then be used as a guide when deciding on standard sample size and when completing the protocol.

2. Organizing the Survey

Preparing a survey protocol

It is important to prepare a written protocol for the survey, which should contain the following information:

- Main objective and purpose of the survey.
- A description of the type of information to be collected and of the methods to be used.
- A description of the sampling methods to be used.
- Personnel and physical arrangements.
- Statistical methods to be used in analysing the data.
- A provisional budget.
- A provisional timetable of main activities and responsible staff.

Obtaining approval from the authorities

Permission to examine population groups must be obtained from a local, regional or national authority. For example, if schoolchildren are to be examined, then the school authorities should be approached, the purpose of the survey explained and their approval obtained. In some instances, written permission from parents must be given before children can be examined. It is the responsibility of the local organizer of the survey to ascertain local practices regarding consent. The survey organizer should also notify the health authorities, since it may be necessary to time the survey to fit in with other health-related activities. This applies particularly when adult populations are to be surveyed.

It is important to provide the dental profession and oral health administrators in the area with details of the survey. Officers of dental societies and local dental practitioners can often help in gaining the cooperation of the community for the survey, and of any of their patients who may be included in the sample.

Budgeting

A budget for the survey should be prepared, which should include all the resources required, including personnel, to carry out the survey. Basic oral health surveys can often be conducted as part of the duties of dental public health workers, and may be undertaken with only minor additions to existing budgets.

Scheduling

One of the most important aspects of survey planning is the preparation of a schedule for data collection. If this is not done, examining personnel may waste time waiting for subjects to arrive, or be otherwise unnecessarily delayed.

The planner can estimate from the preliminary survey, or from previous experience, how much time, on average, each examination will take. As a guideline, a basic examination of a child usually takes about 5–10 minutes, while a complete examination of an adult may take between 15 and 20 minutes. Daily and weekly schedules can then be prepared. These should be made available to survey personnel, as well as to school and health authorities. The schedules should allow for some flexibility so that unexpected delays do not cause major upsets in the survey timetable.

Reliable observations and consistent judgements are important in surveys. Since fatigue contributes significantly to inaccuracy and inconsistency, it is unwise to make the schedule too demanding. For example, if classes of 25–30 children in several schools are to be examined by one examiner, the planning schedule should include time for:

(a) introducing the examining team to the school director and class teachers concerned;
(b) choosing an appropriate place to carry out the examinations in each school, and setting up equipment;
(c) examining one class of 12-year-olds;
(d) providing a brief oral report to the school director; and
(e) travelling to the next school.

Emergency care and referral

If a life-threatening condition, or a condition that requires immediate attention, is detected during the examination, it is the responsibility of the examiner or team leader to ensure that referral to an appropriate care facility is made (see boxes 177–180 on the assessment form). A list of

referral facilities and addresses should therefore be prepared before the survey.

Courtesy reporting

It is appropriate, and often essential, to report the survey findings to local authorities. The report may be a simple summary of the number of subjects examined and the observations of the examiner. This can usually be delivered personally, on the spot. A full technical report will require more time to prepare, but should be sent as soon as it is complete.

3. Reliability and Validity of Data

Training and calibrating examiners

Although examiners may differ in their assessments of the oral health status of individuals, they should be in close agreement in assessing the status of population groups. When an epidemiological survey is undertaken by a team, it is essential that the participating examiners be trained to make consistent clinical judgements. Assistance in training and calibration may be available from WHO (see Chapter 6). There are two main reasons for variability of clinical scoring:

- The difficulty in scoring the different levels of oral diseases, particularly dental caries and periodontal diseases.
- Physical and psychological factors, such as fatigue, fluctuations in interest in the study, and variations in visual acuity and tactile sense. All these affect the judgement of examiners from time to time and to different degrees.

The objectives of standardization and calibration are:

- To ensure uniform interpretation, understanding and application by all examiners of the codes and criteria for the various diseases and conditions to be observed and recorded.
- To ensure that each examiner can examine consistently.

Where possible, an experienced epidemiologist who has been trained in accordance with the recommended methodology for basic oral health surveys should be employed as a trainer and calibrator. Training in the criteria usually takes 2 days with a further 2–3 days for calibration, though extra time may be needed depending on how many examiners are to be trained and the number of indices to be used in a survey. It is desirable to have an interval of at least a few days between training and calibration to allow the examiners time to assimilate knowledge of the indices and practise the procedures.

When only one examiner is involved and an experienced trainer is not

available, the examiner should first practise the examination on a group of 10 subjects with a wide range of levels of disease conditions. Then the examiner should determine how consistently he or she can apply the diagnostic criteria by examining a group of about 20 subjects twice, ideally on successive days, or with a time interval of at least 30 minutes between examinations. These subjects should be pre-selected so that they possess, collectively, the full range of conditions expected to be assessed in the main survey. By comparing the results of the two examinations, the examiner will be able to obtain an estimate of the extent and nature of the diagnostic variability. If the variability is large, the examiner should review the interpretation of the criteria and conduct additional examinations until acceptable consistency is achieved. In general, agreement for most assessments should be in the range of 85–95%.

When the survey is to be conducted by a group of examiners, it is necessary to assess the consistency of each examiner (intra-examiner reproducibility) and also the variations between examiners (inter-examiner reproducibility). When an experienced trainer is not available, each examiner should first practise the examination on a group of 10 subjects. Then each examiner should independently examine the same group of 20 or more subjects and compare his or her findings. When findings contain major discrepancies, subjects should be recalled in order that differences in diagnoses can be reviewed by the examiners and resolved by group discussion. It is essential that a group of examiners should be able to examine with reasonable consistency, using a common standard. If certain examiners consistently produce significantly different results from the majority, and attempts to correct their performance fail, they should be excluded from the survey team. It should be made clear to all potential examiners, before these examinations begin, that ability to standardize examination results is not a measure of clinical skill.

Unless all members of the survey team can examine in a consistent manner, regional or group variations in disease prevalence or severity may be missed or wrongly interpreted. Since there will always be some variation between examiners, it is advisable that, in the actual survey, they should all examine similar percentages of each major subgroup of the sample population.

Duplicate examinations

Examiners may change the way they apply diagnostic criteria during the course of a series of examinations. To allow detection and correction of this tendency, it is advisable for each examiner to perform duplicate examinations on 5–10% of the sample (no less than 25) in the main

survey. The most convenient age groups on which to perform duplicate examinations are likely to be 12- or 15-year-olds because of ease of access. As far as possible, the examiner should not be able to identify the subjects who are re-examined, or know that a subject has been examined previously, since this information may affect the thoroughness or quality of the duplicate examination. The recorder, or perhaps a local schoolteacher, should be requested to arrange for the re-examination of 5–10% of the subjects during the course of the survey. It is recommended that duplicate examinations are conducted at the beginning (i.e. immediately after calibration), about half-way through the survey, and at the end of the survey.

When the survey is to be conducted by a group of examiners, an experienced epidemiologist may be appointed to act as a validator for the survey team. The validator should examine at least 25 subjects who have already been examined by each member of the survey team.

For information on how to calculate the reproducibility of survey results, see Annex 2.

4. Implementing the Survey

General

Contacts with persons in authority

The organization of a survey must commence well before the date on which it is intended to start examinations. It is necessary to contact persons in authority in the institutions or organizations where people will be examined. For example, in schools the principal should be contacted for information as to when the school is in session, when the children will be available for examination, and whether there is a suitable area or room that could be used for the examination. In addition, the principal might be able to provide basic information about the socioeconomic level and nutritional status of the children, water sources, seasonal accessibility of the school, and any health promotion or health education activities carried out in the school.

Keeping a logbook

The organizer of the survey should maintain a logbook in which the location of each day's examinations, the number of persons examined, and information about each survey location are recorded. Occasionally, observations made and impressions formed at this time can have an important bearing on later assessment of survey results. If these are not clearly described at the time of observation, they will either be forgotten or confused.

Preliminary exercise

For investigators planning their first oral health survey, it is helpful to examine two classes of 12-year-old children in local primary schools as a preliminary exercise. This will give the survey personnel an opportunity of working together, and of identifying and discussing any organization or technical problems that may arise. The calibration of the examiners (see

page 13) and training of the recording clerks can be performed at the same time.

Sources of fluorides

A sample of drinking-water should be collected at each examination site and sent for analysis of fluoride content. Clean polyethylene bottles of 25–30-ml capacity should be used for this purpose. They should be rinsed in distilled water prior to rinsing twice with the water to be sampled. The bottles should then be filled, closed firmly and clearly labelled with a permanent ink pen, giving the date of collection, location and source of the water. In many countries, it is possible to obtain fluoride analysis services through public health and/or water supply departments.

In addition, information should be gathered on:

— sources of fluorides available to the survey population, other than water (e.g. salt, tablets and milk);
— levels of usage of topical fluorides, especially dentifrices and/or other products likely to have an impact on dental caries.

Personnel and organization

Recording clerk

Each examiner should be assisted by an alert and cooperative recording clerk who is able to follow instructions exactly and to print numbers and letters clearly (see page 21). The examiner should give the clerk clear instructions about recording data on the assessment form. The clerk should be told the meaning of the terms that will be used and instructed in the coding systems so that, with practice, obvious mistakes or omissions made by the examiner(s) can be recognized. Before the survey begins, the clerk should practise by recording findings from a few preliminary examinations. Special instructions and additional practice must be given if the clerk is not familiar with the alphabetical or numerical symbols used on the assessment form. Failure to ensure that the recording clerk makes clear entries may result in confusion between codes.

When direct-entry computer systems are used, specific instructions and training concerning their use should be given to the recording clerk.

Organizing clerk

It is also desirable to have an organizing clerk at each examination site to maintain a constant flow of subjects to the examiner(s) and to enter

general descriptive information on the record forms. The organizing clerk should also check the finished records for accuracy and completeness, so that missing information may be obtained before the survey team moves to another location. This person should also be responsible for ensuring that the examiners have an adequate supply of sterile instruments.

Daily review of assessment forms

It is very important that each examiner reviews each day's assessment forms on the same day, for completeness and accuracy of recordings.

Instruments and supplies

The quantity and weight of instruments and supplies used in the survey should be kept to a minimum. The following instruments and supplies are required for each examiner:

— plane mouth mirrors;
— periodontal probes which conform to WHO specifications (*1*);
— several pairs of tweezers;
— containers (one for used instruments and one for sterilizing instruments) and concentrated sterilizing solution;
— a wash basin (for either water and soap or disinfectant solution);
— cloth or paper hand towels;
— gauze.

Sufficient numbers of instruments should be available to avoid the need to interrupt examinations while used ones are sterilized. Generally, a minimum of 30 mouth mirrors and 30 periodontal probes per examiner should be provided, as this will permit instruments to be sterilized while the others are being used.

Used instruments should be placed in disinfectant solution, then washed and drained well before sterilization.

Infection control

Current national recommendations and standards should be followed for both infection control and waste disposal.

Examiners are responsible for maintaining adequate infection control in survey procedures. During their training, it should be emphasized that with proper use of dental mirrors and the periodontal probe, all areas of the oral cavity can be fully examined without the need for digital manipulation of the oral tissues, hence reducing the risk of cross-infection.

The use of disposable masks and gloves and the wearing of protective glasses are recommended.

Examination area

The area for conducting examinations should be planned and arranged for maximum efficiency and ease of operation. The exact arrangement will be determined by the physical condition of the site, but certain controllable features should be kept in mind. The lack of a suitable building does not preclude a survey from being performed. If necessary, examinations can be performed outside.

Examination position

The examination position for the subjects will depend on the furniture available. The most comfortable situation is for the subject to lie on a table or bench, and the examiner to sit behind the subject's head. Subjects can also be examined seated in a chair with a high backrest, the examiner standing behind or in front of the chair. If no furniture is available, children can be examined lying on a cloth on the ground, the examiner seated cross-legged behind the child's head.

Lighting

The lighting should be as consistent as possible throughout the survey. If electricity is available at all locations, a lightweight portable examination light (in the blue–white colour spectrum) should be used. Inflammatory and structural changes of the oral tissues are more difficult to detect under normal artificial light (yellow–red in colour) than under natural or corrected artificial light. If electricity or battery-operated lights are not available at some survey sites, natural light should be used at all locations.

If an artificial light source is used, the location of the electrical supply points will affect the positioning of the table or chair. The subject should face away from any natural light sources, to avoid variation in illumination. However, if natural light alone is being used, the subject should be positioned so as to receive maximum illumination, while avoiding discomfort from direct sunlight on either the subject or the examiner. The chair or table should face the opening through which the light enters, and be placed as close to it as possible.

Table or platform

A table or platform to hold dental instruments and basins should be within easy reach of the examiner.

Seating of recording clerk

The recording clerk should sit close enough to the examiner so that instructions and codes can be easily heard and the examiner can see that findings are being recorded correctly. This will also enable the recorder to check that the score recorded relates to the region or tooth that has just been examined.

Supply of survey forms

An adequate supply of assessment forms, carbon paper, hardboard bases and clips, sharpened pencils, erasers and copies of the recording instructions, coding lists and measurement criteria should be readily available.

Avoidance of crowding

If possible, the examination area should be partitioned or arranged in such a way that subjects enter at one point and leave at another. Subjects should not be permitted to crowd around the examiner or recorder but should enter the examination area one at a time.

Avoidance of noise

High noise levels and loud conversations in the examining area can prevent the recording clerk from hearing scores called by the examiner, and may distract the examiner and recorder from the "flow" of the examination.

5. Assessment Form

General

A suitable form for recording the results of oral health assessments described in this manual is reproduced on pages 26–29. Investigators should arrange to have copies reproduced locally.

Standard codes

Standard codes must be used for all sections of the form. If this requirement is not observed, WHO will be unable to process the data and summarize the results as the standard computer program will be unsuitable. If some of the oral health assessments are not carried out, or are not applicable to the age group being examined, the unused sections of the form should be cancelled with a diagonal line, or by using code 9 in the appropriate box (= not recorded).

The forms are designed to facilitate computer processing of the results. Each box is given an identification number (the small number in parentheses), which represents a location in a computer file. Recording codes are shown near the appropriate boxes. To minimize the number of errors, all entries must be clear and unambiguous. Confusing similarities commonly occur in writing 1 and 7, 2 and 4, 6 and 0, and B and 8. To avoid confusion and the danger of computing inaccurate results, numerals should be written clearly in the following manner:

1234567890

When letters are used, as under dentition status and treatment needs, they should be written in capitals as follows:

ABCDEFGPT

Clear enunciation is essential when calling out scores to recorders in order to differentiate unmistakably between similar sounding codes, e.g. eight and A.

The two-digit numbers above or below some of the boxes indicate specific teeth, according to the system used by the International Dental Federation (FDI). The first digit specifies the quadrant of the mouth and the second the actual tooth (see Figs. 1 and 2).

In designating a tooth, the examiner should call the quadrant number, then the tooth number—for example, the upper right second incisor, 12 = "one-two" rather than "twelve"; the lower left third molar, 38 = "three-eight" rather than "thirty-eight".

Oral health assessment form

The standard form for oral health assessment (see pages 26–29) is designed for collection of all the information needed for planning oral care services and thorough monitoring and replanning of existing care services. The form includes the following sections:

- survey identification information;
- general information;
- extra-oral examination;
- temporomandibular joint assessment;
- oral mucosa;
- enamel opacities/hypoplasia;
- dental fluorosis;
- CPI (periodontal status, formerly called Community Periodontal Index of Treatment Needs or CPITN);
- loss of attachment;
- dentition status and treatment need;
- prosthetic status;
- prosthetic need;
- dentofacial anomalies;
- need for immediate care and referral;
- notes.

This form is suitable for surveying children as well as adults. Where only children are examined, it would not usually be necessary to record the presence of oral mucosal lesions, root caries, or prosthetic status or need. Similarly, if adults only are examined, it may be of little use to record dentofacial anomalies. For certain communities where extrinsic staining or other deposits obscure observation of tooth surfaces, it might also be impossible to score enamel opacities/hypoplasia or dental fluorosis.

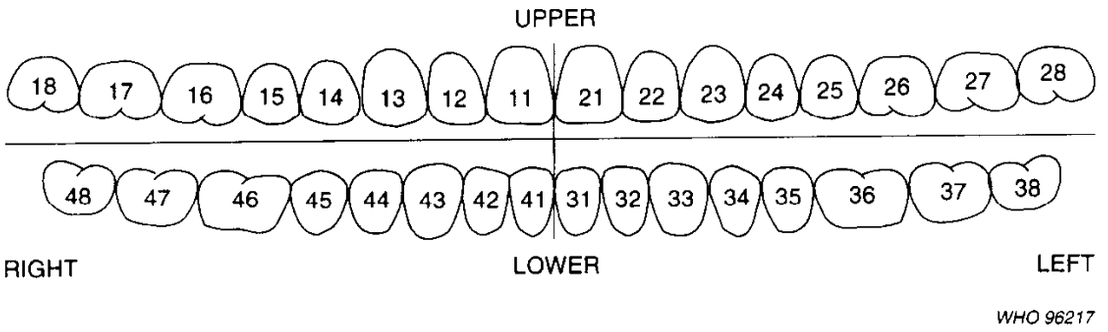


Fig. 1. Permanent teeth codes

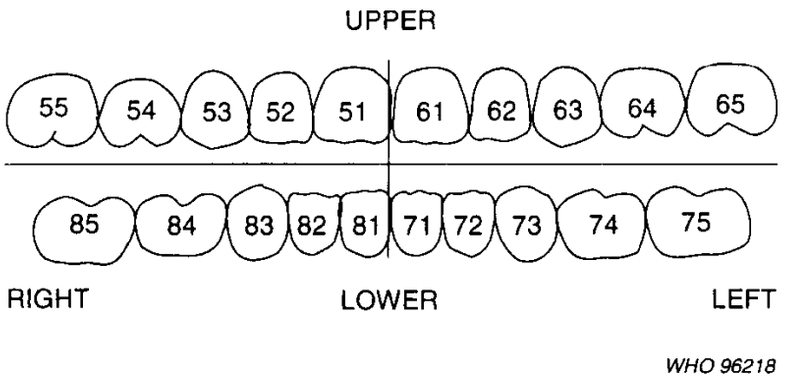


Fig. 2. Primary teeth codes

Identification and general information sections of the form

The investigator should write the name of the country in which the survey was conducted in capital letters on the original assessment form before making additional copies. Boxes 1–4 on the form are reserved for the WHO code for the country in which the survey is carried out and should *not* be filled in by the investigator.

During the planning of the survey, a list of examination sites should be made and a two-digit code assigned to each one. The appropriate code should then be recorded in boxes 26 and 27 of each form during the survey. Similarly, a list of the examiners who will be involved in the study should be made and a code assigned to each one. If there is information about ethnic groups and occupations, or if it is intended to record other information such as fluoride content of the water or use of fluoride tablets,

then the codes for this information should also be included in the coding list. This information should be entered in boxes 24, 25, 29 and 30. The coding list should be distributed to all examiners and recorders before the examinations begin; this information should also be recorded on the survey summary sheet (Annex 1).

Date of examination (boxes 5–10)

The year, month and day should be written on the form at the time of the examination. Only the year and month (recorded in boxes 5–8) will be entered into the computer data file. Recording the day enables an investigator to refer back to any one day's examinations that may need to be reviewed or checked.

Identification number (boxes 11–14)

Each subject examined should be given an identification number. This number should always have the same number of digits as the total number of subjects to be examined. Thus, if it is intended to examine 1200 subjects, the first subject should be numbered 0001.

If possible, the identification numbers should be entered on the forms before the day's work starts. It is important to ensure that each identification number is used only once. Cross-checking is necessary when more than one examiner participates in a survey. If a total of 1200 subjects are to be surveyed by two examiners, examiner 1 should use numbers 0001–0600, and examiner 2, numbers 0601–1200.

Examiner (box 15)

If more than one examiner is participating in the survey, each examiner should be assigned a specific code which should be entered in box 15. Similarly, if a validating examiner is participating in the survey, he or she should also be assigned a specific code.

Original/duplicate examinations (box 16)

If the subject is being re-examined to assess reproducibility, then the first (original) examination is scored "1" and any subsequent duplication examinations are coded 2, 3, 4, etc. in box 16. For all subjects for which duplicate examinations have been made, data from the first examination only are included in the survey analysis.

Name

The name of the subject may be written in block letters, beginning with the family name. It should be noted that, in some countries, identification of survey subjects by name is not permitted, in which case this space should be left blank.

Date of birth (boxes 17–20)

Where possible, the year and month of birth should be entered for cross-checking purposes.

Age (boxes 21 and 22)

Age should be recorded as age at last birthday (i.e. a child in the 13th year of life is 12). If the age is less than 10 years, "0" should be entered in box 21 (i.e. 6 years = 06). In communities where age is normally expressed in another way, a conversion must be made. If the age of the subject is not known, it may be necessary to make an estimate on the basis of, for instance, stage of tooth eruption or, for adults, major events in the community. Where age has been estimated, the manner of estimation should be reported.

Sex (box 23)

This information should be recorded at the time of examination because it is not always possible to tell a person's sex from name alone. The appropriate code (1 = male, 2 = female) should be entered in box 23.

Ethnic group (box 24)

In different countries, ethnic and other groups are identified in different ways, e.g. by area or country of origin, race, colour, language, religion or tribal membership. Local health and education authorities should be consulted before any decision is made as to which ethnic groups should be recorded. When this decision has been reached, a coding system should be made.

Note: The codes 0–8 may be used to identify different subgroups. Since it is often not possible to identify a person's ethnic origin from name alone, ethnic group information must be recorded at the time of the examination and coded in box 24.

WHO ORAL HEALTH ASSESSMENT FORM (1997)

Country .....

Leave blank (1) ☐☐☐☐ (4) | Year Month (5) ☐☐☐☐ (8) | Day (9) ☐☐ (10) | Identification number (11) ☐☐☐☐ (14) | Examiner ☐ (15) | Original/duplicate ☐ (16)

GENERAL INFORMATION

Name .....

Year Month

Date of birth (17) ☐☐☐☐ (20)

Age in years (21) ☐☐ (22)

Sex (M = 1, F = 2) ☐ (23)

Ethnic group ☐ (24)

Occupation ☐ (25)

Geographical location (26) ☐☐ (27)

Location type: ☐ (28)
1 = Urban
2 = Periurban
3 = Rural

OTHER DATA (specify and provide codes)

..... ☐ (29)

..... ☐ (30)

CONTRAINDICATION TO EXAMINATION

Reason: ..... ☐ (31)

..... 0 = No
1 = Yes

CLINICAL ASSESSMENT

EXTRA-ORAL EXAMINATION

0 = Normal extra-oral appearance
1 = Ulceration, sores, erosions, fissures (head, neck, limbs)
2 = Ulceration, sores, erosions, fissures (nose, cheeks, chin)
3 = Ulceration, sores, erosions, fissures (commissures)
4 = Ulceration, sores, erosions, fissures (vermilion border)
5 = Cancrum oris
6 = Abnormalities of upper and lower lips
7 = Enlarged lymph nodes (head, neck)
8 = Other swellings of face and jaws
9 = Not recorded

☐ (32)

TEMPOROMANDIBULAR JOINT ASSESSMENT

SYMPTOMS
0 = No
1 = Yes
9 = Not recorded

☐ (33)

SIGNS
0 = No
1 = Yes
9 = Not recorded

Clicking ☐ (34)
Tenderness (on palpation) ☐ (35)
Reduced jaw mobility (< 30 mm opening) ☐ (36)

ORAL MUCOSA

CONDITION

0 = No abnormal condition
1 = Malignant tumour (oral cancer)
2 = Leukoplakia
3 = Lichen planus
4 = Ulceration (aphthous, herpetic, traumatic)
5 = Acute necrotizing gingivitis
6 = Candidiasis
7 = Abscess
8 = Other condition (specify if possible) .....
9 = Not recorded

(37) ☐ ☐ (40)
(38) ☐ ☐ (41)
(39) ☐ ☐ (42)

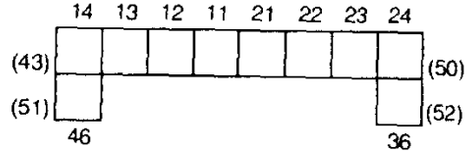
LOCATION

0 = Vermilion border
1 = Commissures
2 = Lips
3 = Sulci
4 = Buccal mucosa
5 = Floor of mouth
6 = Tongue
7 = Hard and/or soft palate
8 = Alveolar ridges/gingiva
9 = Not recorded

ENAMEL OPACITIES/HYPOPLASIA

Permanent teeth

0 = Normal
1 = Demarcated opacity
2 = Diffuse opacity
3 = Hypoplasia
4 = Other defects
5 = Demarcated and diffuse opacities
6 = Demarcated opacity and hypoplasia
7 = Diffuse opacity and hypoplasia
8 = All three conditions
9 = Not recorded



DENTAL FLUOROSIS

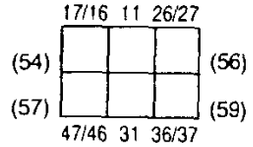
0 = Normal
1 = Questionable
2 = Very mild
3 = Mild
4 = Moderate
5 = Severe
8 = Excluded
9 = Not recorded

☐ (53)

COMMUNITY PERIODONTAL INDEX (CPI)

0 = Healthy
1 = Bleeding
2 = Calculus
3* = Pocket 4–5 mm (black band on probe partially visible)
4* = Pocket 6 mm or more (black band on probe not visible)
X = Excluded sextant
9 = Not recorded

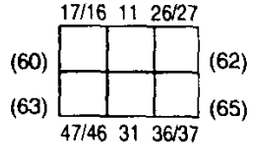
* Not recorded under 15 years of age



LOSS OF ATTACHMENT*

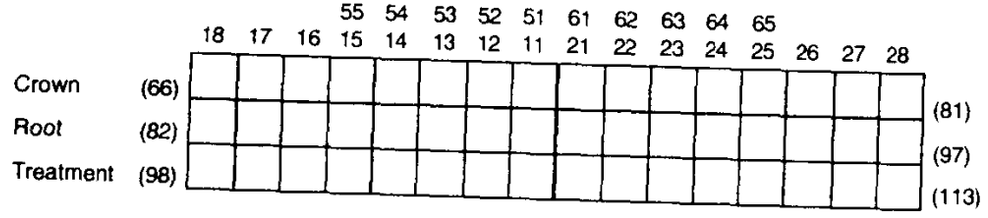
0 = 0–3 mm
1 = 4–5 mm (cementoenamel junction (CEJ) within black band)
2 = 6–8 mm (CEJ between upper limit of black band and 8.5-mm ring)
3 = 9–11 mm (CEJ between 8.5-mm and 11.5-mm rings)
4 = 12 mm or more (CEJ beyond 11.5-mm ring)
X = Excluded sextant
9 = Not recorded

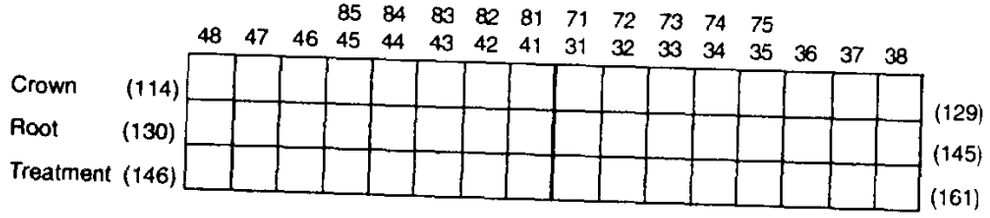
*Not recorded under 15 years of age



DENTITION STATUS AND TREATMENT NEED

Identification number





Primary teeth *Crown*	Permanent teeth *Crown/Root*		STATUS
A	0	0	Sound
B	1	1	Decayed
C	2	2	*Filled, with decay*
D	3	3	Filled, no decay
E	4	—	Missing, as a result of caries
—	5	—	Missing, any other reason
F	6	—	Fissure sealant
G	7	7	Bridge abutment, *special crown or* veneer/implant
—	8	8	Unerupted tooth, (crown)/unexposed root
T	*T*	—	Trauma (fracture)
—	9	9	Not recorded

TREATMENT
0 = None
P = Preventive, caries-arresting care
F = Fissure sealant
1 = One surface filling
2 = *Two or more surface* fillings
3 = Crown for any reason
4 = Veneer or laminate
5 = Pulp care and restoration
6 = Extraction
7 = Need for other care (specify).....
8 = Need for other care (specify).....
9 = Not recorded

PROSTHETIC STATUS

Upper Lower
(162) ☐☐ (163)

0 = No prosthesis
1 = Bridge
2 = More than one bridge
3 = Partial denture
4 = Both bridge(s) and partial denture(s)
5 = Full removable denture
9 = Not recorded

PROSTHETIC NEED

Upper Lower
(164) ☐☐ (165)

0 = No prosthesis needed
1 = Need for one-unit prosthesis
2 = Need for multi-unit prosthesis
3 = Need for a combination of one- and/or multi-unit prostheses
4 = Need for full prosthesis (replacement of all teeth)
9 = Not recorded

DENTOFACIAL ANOMALIES

DENTITION

(166) ☐☐ (167) Missing incisor, canine and premolar teeth—maxillary and mandibular—enter number of teeth

SPACE

☐(168) Crowding in the incisal segments:

0 = No crowding
1 = One segment crowded
2 = Two segments crowded

☐(169) Spacing in the incisal segments:

0 = No spacing
1 = One segment spaced
2 = Two segments spaced

☐(170) Diastema in mm

☐(171) Largest anterior maxillary irregularity in mm

☐(172) Largest anterior mandibular irregularity in mm

OCCLUSION

☐(173) Anterior maxillary overjet in mm

☐(174) Anterior mandibular overjet in mm

☐(175) Vertical anterior openbite in mm

☐(176) Antero-posterior molar relation:

0 = Normal
1 = Half cusp
2 = Full cusp

NEED FOR IMMEDIATE CARE AND REFERRAL

Life-threatening condition ☐(177)

Pain or infection ☐(178)

Other condition (specify)..... ☐(179)

0 = Absent
1 = Present
9 = Not recorded

Referral ☐(180)
0 = No
1 = Yes
9 = Not recorded

NOTES

Occupation (box 25)

A coding system should be devised according to local usage for recording occupation groups and the appropriate code entered in box 25.

Note: The codes 0–8 may be used to identify different occupations.

Geographical location (boxes 26 and 27)

Boxes 26 and 27 should be used to record the site where the examination is conducted. This allows up to 99 geographical locations (villages, schools, etc.) to be identified (00–98). A list relating each location to its code number should be prepared. Usually, only a few codes are needed. The code "99" should be entered if this information is not recorded.

Location type (box 28)

Box 28 is provided for recording information about each survey site. The purpose of including these data is to obtain general information about the availability of services at each survey site. Three codes are used:

1 — Urban site.
2 — Periurban area: this has been included in order to indicate areas surrounding major towns, which may have characteristics similar to those of rural areas, i.e. very few health facilities of any kind and usually no access to oral health care facilities.
3 — Rural area or small village.

Other data (boxes 29 and 30)

Two boxes—29 and 30—have been provided for recording other information about the subjects examined or the survey location. Information such as use of tobacco or a chew stick, refugee status, or the level of fluoride in the water can be recorded here; if sugar intake was of interest, a system could be designed by the investigator whereby the level and frequency of intake were given suitable codes. It would then be possible to summarize the results of the survey according to the different codes placed in these boxes.

Note: The codes 0–8 may be used in these boxes.

Contraindication to examination (box 31)

Local practices must be taken into consideration when establishing the presence of conditions contraindicating the conduct of any part of the

examination which might place subjects at risk or cause them discomfort. Examiners should use their judgement in this matter.

The following codes are used:

0 — No contraindication.
1 — Contraindication.

Clinical assessment

In order to ensure that all conditions are detected and diagnosed, it is recommended that the clinical examination follows the order of the assessment form.

Extra-oral examination (box 32)

The extra-oral examination should be performed in the following sequence:

(a) general overview of exposed skin areas (head, neck, limbs);
(b) perioral skin areas (nose, cheeks, chin);
(c) lymph nodes (head, neck);
(d) cutaneous parts of upper and lower lips;
(e) vermilion border and commissures;
(f) temporomandibular joint (TMJ) and parotid gland region.

The following codes and criteria are used:

0 — Normal extra-oral appearance.
1 — Ulceration, sores, erosions, fissures—head, neck, limbs.
2 — Ulceration, sores, erosions, fissures—nose, cheeks, chin.
3 — Ulceration, sores, erosions, fissures—commissures.
4 — Ulceration, sores, erosions, fissures—vermilion border.
5 — Cancrum oris.
6 — Abnormalities of upper and lower lips (e.g. clefts).
7 — Enlarged lymph nodes—head, neck.
8 — Other swellings of the face and jaws.
9 — Not recorded.

Temporomandibular joint assessment (boxes 33–36)

Symptoms (box 33). The following codes and criteria are used:

0 — No symptoms.
1 — Occurrence of clicking, pain, or difficulties in opening or closing the jaw once or more per week.
9 — Not recorded.

Signs (boxes 34–36). The following codes and criteria are used:

0 — No signs.
1 — Occurrence of clicking, tenderness (on palpation) or reduced jaw mobility (opening <30 mm).
9 — Not recorded.

Clicking (box 34) of one or both temporomandibular joints. Clicking is evaluated directly by an audible sharp sound or by palpation of the temporomandibular joints.

Tenderness (on palpation) (box 35) of the anterior temporalis and/or masseter muscles on one or both sides. The tenderness should be evaluated by unilateral palpation with the firm pressure of two fingers, exerted twice on the most voluminous part of the muscle. Tenderness is recorded only if the palpation spontaneously provokes an avoidance reflex.

Reduced jaw mobility—opening of <30 mm (box 36), taken as the distance between the incisal tips of the central maxillary and mandibular incisors. As a general guide, in an adult jaw, mobility is considered to be reduced if the subject is unable to open his or her jaw to the width of two fingers.

Oral mucosa (boxes 37–42)

An examination of the oral mucosa and soft tissues in and around the mouth should be made on every subject. The examination should be thorough and systematic and be performed in the following sequence:

(a) Labial mucosa and labial sulci (upper and lower).
(b) Labial part of the commissures and buccal mucosa (right and left).
(c) Tongue (dorsal and ventral surfaces, margins).
(d) Floor of the mouth.
(e) Hard and soft palate.
(f) Alveolar ridges/gingiva (upper and lower).

Either two mouth mirrors or one mirror and the handle of the periodontal probe can be used to retract the tissues. Boxes 37–39 should be used to record the absence, presence, or *suspected* presence, of the conditions coded 1 to 7 for which examiners can make a tentative diagnosis and to which they should be alert during clinical examinations. Code 8 should be used to record a condition not mentioned in the precoded list; for example, hairy leukoplakia or Kaposi sarcoma. Whenever possible, the tentative diagnosis should be specified in the space provided.

The codes and criteria are:

0 — No abnormal condition.
1 — Malignant tumour (oral cancer).
2 — Leukoplakia.
3 — Lichen planus.
4 — Ulceration (aphthous, herpetic, traumatic).
5 — Acute necrotizing gingivitis.
6 — Candidiasis.
7 — Abscess.
8 — Other condition (specify if possible).
9 — Not recorded.

The main location of the oral mucosal lesion(s) should be recorded in boxes 40–42 as follows:

0 — Vermilion border.
1 — Commissures.
2 — Lips.
3 — Sulci.
4 — Buccal mucosa.
5 — Floor of the mouth.
6 — Tongue.
7 — Hard and/or soft palate.
8 — Alveolar ridges/gingiva.
9 — Not recorded.

For example, if a person has leukoplakia on both the buccal mucosa and the commissures, the coding would be as follows:

(37)	2	4	(40)
(38)	2	1	(41)
(39)			(42)

Similarly, where a person has oral cancer on the commissures and the lower lip, and candidiasis on the tongue, the coding should be as follows:

(37)	1	1	(40)
(38)	1	2	(41)
(39)	6	6	(42)

Some of the more important pathological conditions affecting the oral mucosa are illustrated in Plate 1.

Enamel opacities/hypoplasia (boxes 43–52)

The modified developmental defects of enamel (DDE) index (*2*, *3*) is used. Enamel abnormalities are classified into one of three types on the basis of their appearance. They vary in their extent, position on the tooth surface, and distribution within the dentition.

The codes and criteria are as follows:

0 — *Normal.*

1 — *Demarcated opacity.* In enamel of normal thickness and with an intact surface, there is an alteration in the translucency of the enamel, variable in degree. It is demarcated from the adjacent normal enamel with a distinct and clear boundary and can be white, cream, yellow or brown in colour.

2 — *Diffuse opacity.* Also an abnormality involving an alteration in the translucency of the enamel, variable in degree, and white in colour. There is no clear boundary between the adjacent normal enamel and the opacity can be linear or patchy or have a confluent distribution.

3 — *Hypoplasia.* A defect involving the surface of the enamel and associated with a localized reduction in the thickness of the enamel. It can occur in the form of: (a) pits—single or multiple, shallow or deep, scattered, or in rows arranged horizontally across the tooth surface; (b) grooves—single or multiple, narrow or wide (max. 2 mm); or (c) partial or complete absence of enamel over a considerable area of dentine. The affected enamel may be translucent or opaque.

4 — *Other defects.*

5 — *Demarcated and diffuse opacities.*

6 — *Demarcated opacity and hypoplasia.*

7 — *Diffuse opacity and hypoplasia.*

8 — *All three conditions.*

9 — *Not recorded.*

Photographs of typical examples of enamel opacities and hypoplasias are shown in Plates 2 and 3.

Clinical examination. Ten index teeth should be examined on the buccal surfaces only and coded in boxes 43–52. If any index teeth are missing, the relevant box(es) should be left blank.

	14	13	12	11	21	22	23	24	
46									36

Buccal surfaces, i.e. from the incisal edges or cuspal points to the gingiva and from the mesial to the distal embrasure, should be inspected visually for defects and, if there is any doubt, areas such as hypoplastic pits should be checked with the periodontal probe to confirm the diagnosis. Any gross plaque or food deposits should be removed and the teeth should be examined in a wet condition.

Specific areas of concern in differentiating between enamel opacities and other changes in dental enamel are: (a) white spot decay; and (b) white cuspal and marginal ridges on premolar and molar teeth and, occasionally, on lateral incisors.

If there is any doubt about the presence of an abnormality, the tooth surface should be scored "normal" (code 0). Similarly, a tooth surface with a single abnormality less than 1 mm in diameter should be scored "0". Any abnormality that cannot be readily classified into one of the three basic types should be scored "other defects" (code 4). A tooth should be regarded as present once any part of it has penetrated the mucosa and any abnormality present on the erupted portion should be recorded. If more than two-thirds of a tooth surface is heavily restored, badly decayed or fractured, it should not be examined (code 9).

Note: It is strongly recommended that, when examiners are trained and calibrated, subjects with a variety of enamel opacities/hypoplasias should be included in the group being examined.

Dental fluorosis (box 53)

Fluorotic lesions are usually bilaterally symmetrical and tend to show a horizontal striated pattern across the tooth. The premolars and second molars are most frequently affected, followed by the upper incisors. The mandibular incisors are least affected.

The examiner should note the distribution pattern of any defects and decide if they are typical of fluorosis. The defects in the "questionable" to "mild" categories (the most likely to occur) may consist of fine white lines or patches, usually near the incisal edges or cusp tips. They are paper-white or frosted in appearance like a snow-capped mountain and tend to fade into the surrounding enamel.

It is recommended that Dean's index criteria (*3*) be used. The recording is made on the basis of the two teeth that are most affected. If the two teeth are not equally affected, the score for the less affected of the two

should be recorded. When teeth are scored, the examiner should start at the higher end of the index, i.e. "severe", and eliminate each score until he or she arrives at the condition present. If there is any doubt, the lower score should be given.

The codes and criteria are as follows:

0 — *Normal.* The enamel surface is smooth, glossy and usually a pale creamy-white colour.
1 — *Questionable.* The enamel shows slight aberrations from the translucency of normal enamel, which may range from a few white flecks to occasional spots.
2 — *Very mild.* Small, opaque, paper-white areas scattered irregularly over the tooth but involving less than 25% of the labial tooth surface.
3 — *Mild.* The white opacity of the enamel of the teeth is more extensive than for code 2, but covers less than 50% of the tooth surface.
4 — *Moderate.* The enamel surfaces of the teeth show marked wear and brown stain is frequently a disfiguring feature.
5 — *Severe.* The enamel surfaces are badly affected and hypoplasia is so marked that the general form of the tooth may be affected. There are pitted or worn areas and brown stains are widespread; the teeth often have a corroded appearance.
8 — *Excluded* (e.g. a crowned tooth).
9 — *Not recorded.*

Examples of coding of dental fluorosis according to Dean's index criteria and of other abnormalities of the enamel are shown in Plates 2 and 3.

Community Periodontal Index (CPI) (boxes 54–59)

Indicators. Three indicators of periodontal status are used for this assessment: gingival bleeding, calculus and periodontal pockets.

A specially designed lightweight CPI probe with a 0.5-mm ball tip is used, with a black band between 3.5 and 5.5mm and rings at 8.5 and 11.5mm from the ball tip.

Sextants. The mouth is divided into sextants defined by tooth numbers: 18–14, 13–23, 24–28, 38–34, 33–43 and 44–48. A sextant should be examined only if there are two or more teeth present which are not indicated for extraction. (*Note*: This replaces the former instruction to include single remaining teeth in the adjacent sextant.)

Index teeth. For adults aged 20 years and over, the teeth to be examined are:

17	16	11	26	27
47	46	31	36	37.

The two molars in each posterior sextant are paired for recording and, if one is missing, there is no replacement. If no index teeth or tooth is present in a sextant qualifying for examination, all the remaining teeth in that sextant are examined and the highest score is recorded as the score for the sextant. In this case, distal surfaces of third molars should not be scored.

For subjects under the age of 20 years, only six index teeth—16, 11, 26, 36, 31 and 46—are examined. This modification is made in order to avoid scoring the deepened sulci associated with eruption as periodontal pockets. For the same reason, when children under the age of 15 are examined, pockets should not be recorded, i.e. only bleeding and calculus should be considered.

Sensing gingival pockets and calculus. An index tooth should be probed, using the probe as a "sensing" instrument to determine pocket depth and to detect subgingival calculus and bleeding response. The sensing force used should be no more than 20 grams. A practical test for establishing this force is to place the probe point under the thumb nail and press until blanching occurs. For sensing subgingival calculus, the lightest possible force that will allow movement of the probe ball tip along the tooth surface should be used.

When the probe is inserted, the ball tip should follow the anatomical configuration of the surface of the tooth root. If the patient feels pain during probing, this is indicative of the use of too much force.

The probe tip should be inserted gently into the gingival sulcus or pocket and the total extent of the sulcus or pocket explored. For example, the probe is placed in the pocket at the disto-buccal surface of the second molar, as close as possible to the contact point with the third molar, keeping the probe parallel to the long axis of the tooth. The probe is then moved gently, with short upward and downward movements, along the buccal sulcus or pocket to the mesial surface of the second molar, and from the disto-buccal surface of the first molar towards the contact area with the premolar. A similar procedure is carried out for the lingual surfaces, starting distolingually to the second molar.

Examination and recording. The index teeth, or all remaining teeth in a sextant where there is no index tooth, should be probed and the highest score recorded in the appropriate box. The codes are:

0 — Healthy.
1 — Bleeding observed, directly or by using a mouth mirror, after probing.
2 — Calculus detected during probing, but all of the black band on the probe visible.
3 — Pocket 4–5 mm (gingival margin within the black band on the probe).
4 — Pocket 6 mm or more (black band on the probe not visible).
X — Excluded sextant (less than two teeth present).
9 — Not recorded.

These codings are illustrated in Plate 4 and Fig. 3.

Loss of attachment (boxes 60–65)

Information on loss of attachment may be collected from index teeth in order to obtain an estimate of the lifetime accumulated destruction of the periodontal attachment. This permits comparisons between population groups but is not intended to describe the full extent of loss of attachment in an individual.

The most reliable way of examining for loss of attachment in each sextant is to record this immediately after recording the CPI score for that particular sextant. The highest scores for CPI and loss of attachment may not necessarily be found on the same tooth in a sextant.

Loss of attachment should not be recorded for children under the age of 15.

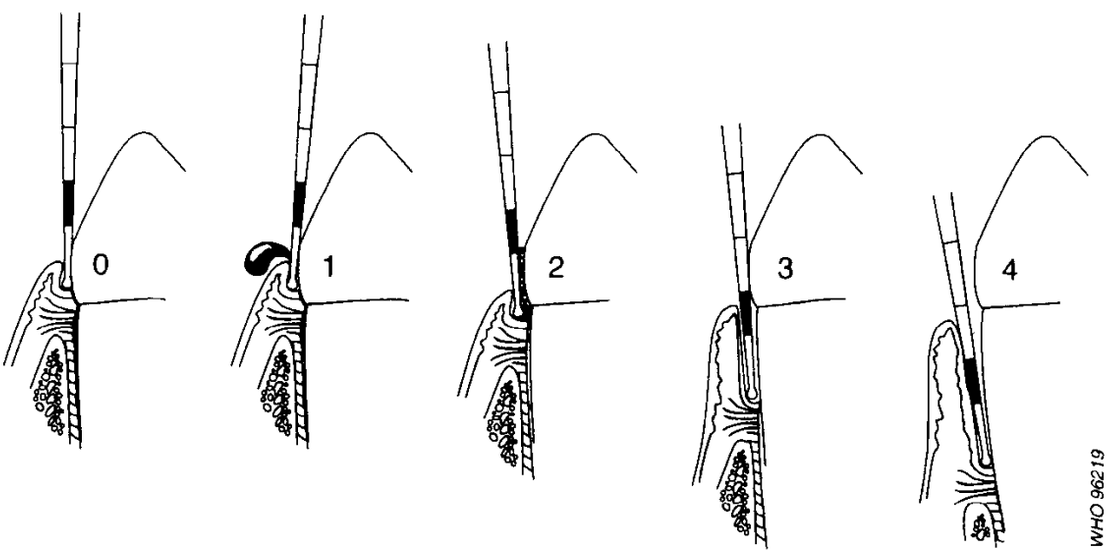


Fig. 3. Examples of coding according to the Community Periodontal Index, showing the position of the CPI probe

Probing pocket depths gives some indication of the extent of loss of attachment. This measurement is unreliable when there is gingival recession, i.e. when the cementoenamel junction (CEJ) is visible. When the CEJ is not visible and the highest CPI score for a sextant is less than 4 (probing depth less than 6 mm), any loss of attachment for that sextant is estimated to be less than 4 mm (loss of attachment score = 0). The extent of loss of attachment is recorded using the following codes (see Fig. 4):

0 — Loss of attachment 0–3 mm (CEJ not visible and CPI score 0–3).

If the CEJ is not visible and the CPI score is 4, or if the CEJ is visible:

1 — Loss of attachment 4–5 mm (CEJ within the black band).
2 — Loss of attachment 6–8 mm (CEJ between the upper limit of the black band and the 8.5-mm ring).
3 — Loss of attachment 9–11 mm (CEJ between the 8.5-mm and 11.5-mm rings).
4 — Loss of attachment 12 mm or more (CEJ beyond the 11.5-mm ring).
X — Excluded sextant (less than two teeth present).
9 — Not recorded (CEJ neither visible nor detectable).

Dentition status and treatment need (boxes 66–161)

The examination for dental caries should be conducted with a plane mouth mirror. Radiography for detection of approximal caries is not recommended because of the impracticability of using the equipment in all situations. Likewise, the use of fibre optics is not recommended. Although it is realized that both these diagnostic aids will reduce the

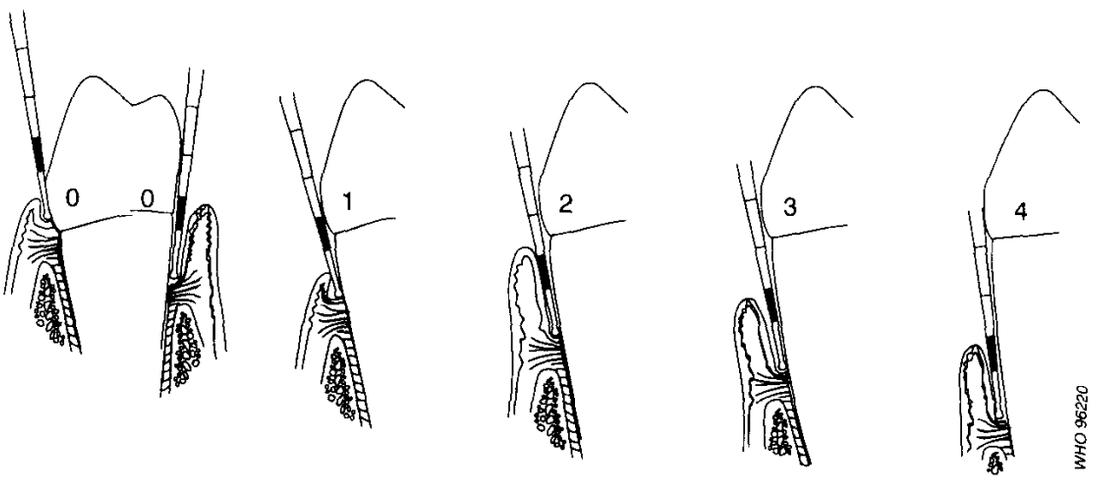


Fig. 4. Examples of coding for loss of attachment with a CPI probe

underestimation of the need for restorative care, the extra complication and frequent objections to exposure to radiation outweigh the gains to be expected.

Examiners should adopt a systematic approach to the assessment of dentition status and treatment needs. The examination should proceed in an orderly manner from one tooth or tooth space to the adjacent tooth or tooth space. A tooth should be considered present in the mouth when any part of it is visible. If a permanent and primary tooth occupy the same tooth space, the status of the permanent tooth only should be recorded.

Dentition status. Both letters and numbers are used for recording dentition status. Boxes 66–97 are used for upper teeth and boxes 114–145 for lower teeth. The same boxes are used for recording both primary teeth and their permanent successors. An entry must be made in every box pertaining to coronal and root status. In the case of surveys of children, where the root status is not assessed, a code "9" (not recorded) should be entered in the box pertaining to root status.

Note: Considerable care should be taken to diagnose tooth-coloured fillings, which may be extremely difficult to detect.

Codes for the dentition status of primary and permanent teeth (crowns and roots) are given in the table below.

Code			Condition/status
Primary teeth	Permanent teeth		
Crown	Crown	Root	
A	0	0	Sound
B	1	1	Decayed
C	2	2	Filled, with decay
D	3	3	Filled, no decay
E	4	—	Missing, as a result of caries
—	5	—	Missing, any other reason
F	6	—	Fissure sealant
G	7	7	Bridge abutment, special crown or veneer/implant
—	8	8	Unerupted tooth (crown)/unexposed root
T	T	—	Trauma (fracture)
—	9	9	Not recorded

The criteria for diagnosis and coding (primary tooth codes within parentheses) are:

0 (A) *Sound crown.* A crown is recorded as sound if it shows no evidence of treated or untreated clinical caries. The stages of caries that precede cavitation, as well as other conditions similar to the early stages of caries, are excluded because they cannot be reliably diagnosed. Thus, a crown with the following defects, in the absence of other positive criteria, should be coded as sound:

— white or chalky spots;
— discoloured or rough spots that are not soft to touch with a metal CPI probe;
— stained pits or fissures in the enamel that do not have visual signs of undermined enamel, or softening of the floor or walls detectable with a CPI probe;
— dark, shiny, hard, pitted areas of enamel in a tooth showing signs of moderate to severe fluorosis;
— lesions that, on the basis of their distribution or history, or visual/tactile examination, appear to be due to abrasion.

Sound root. A root is recorded as sound when it is exposed and shows no evidence of treated or untreated clinical caries. (Unexposed roots are coded 8.)

1 (B) *Decayed crown.* Caries is recorded as present when a lesion in a pit or fissure, or on a smooth tooth surface, has an unmistakable cavity, undermined enamel, or a detectably softened floor or wall. A tooth with a temporary filling, or one which is sealed (code 6 (F)) but also decayed, should also be included in this category. In cases where the crown has been destroyed by caries and only the root is left, the caries is judged to have originated on the crown and therefore scored as crown caries only. The CPI probe should be used to confirm visual evidence of caries on the occlusal, buccal and lingual surfaces. Where any doubt exists, caries should not be recorded as present.

Decayed root. Caries is recorded as present when a lesion feels soft or leathery to probing with the CPI probe. If the root caries is discrete from the crown and will require a separate treatment, it should be recorded as root caries. For single carious lesions affecting both the crown and the root, the likely site of origin of the lesion should be recorded as decayed. When it is not possible to judge the

site of origin, both the crown and the root should be recorded as decayed.

2 (C) *Filled crown, with decay.* A crown is considered filled, with decay, when it has one or more permanent restorations and one or more areas that are decayed. No distinction is made between primary and secondary caries (i.e. the same code applies whether or not the carious lesions are in physical association with the restoration(s)).

Filled root, with decay. A root is considered filled, with decay, when it has one or more permanent restorations and one or more areas that are decayed. No distinction is made between primary and secondary caries.

In the case of fillings involving both the crown and the root, judgement of the site of origin is more difficult. For any restoration involving both the crown and the root with secondary caries, the most likely site of the primary carious lesion is recorded as filled, with decay. When it is not possible to judge the site of origin of the primary carious lesion, both the crown and the root should be recorded as filled, with decay.

3 (D) *Filled crown, with no decay.* A crown is considered filled, without decay, when one or more permanent restorations are present and there is no caries anywhere on the crown. A tooth that has been crowned because of previous decay is recorded in this category. (A tooth that has been crowned for reasons other than decay, e.g. a bridge abutment, is coded 7 (G).)

Filled root, with no decay. A root is considered filled, without decay, when one or more permanent restorations are present and there is no caries anywhere on the root.

In the case of fillings involving both the crown and the root, judgement of the site of origin is more difficult. For any restoration involving both the crown and the root, the most likely site of the primary carious lesion is recorded as filled. When it is not possible to judge the site of origin, both the crown and the root should be recorded as filled.

4 (E) *Missing tooth, as a result of caries.* This code is used for permanent or primary teeth that have been extracted because of caries and is recorded under coronal status. For missing primary teeth, this score should be used only if the subject is at an age when normal exfoliation would not be a sufficient explanation for absence.

Note: The root status of a tooth that has been scored as missing because of caries should be coded "7" or "9".

In some age groups, it may be difficult to distinguish between unerupted teeth (code 8) and missing teeth (codes 4 or 5). Basic knowledge of tooth eruption patterns, the appearance of the alveolar ridge in the area of the tooth space in question, and the caries status of other teeth in the mouth may provide helpful clues in making a differential diagnosis between unerupted and extracted teeth. Code 4 should not be used for teeth judged to be missing for any reason other than caries. For convenience, in fully edentulous arches, a single "4" should be placed in boxes 66 and 81 and/or 114 and 129, as appropriate, and the respective pairs of numbers linked with straight lines.

5 (–) *Permanent tooth missing, for any other reason.* This code is used for permanent teeth judged to be absent congenitally, or extracted for orthodontic reasons or because of periodontal disease, trauma, etc. As for code 4, two entries of code 5 can be linked by a line in cases of fully edentulous arches.

Note: The root status of a tooth scored 5 should be coded "7" or "9".

6 (F) *Fissure sealant.* This code is used for teeth in which a fissure sealant has been placed on the occlusal surface; or for teeth in which the occlusal fissure has been enlarged with a rounded or "flame-shaped" bur, and a composite material placed. If a tooth with a sealant has decay, it should be coded as 1 or B.

7 (G) *Bridge abutment, special crown or veneer.* This code is used under coronal status to indicate that a tooth forms part of a fixed bridge, i.e. is a bridge abutment. This code can also be used for crowns placed for reasons other than caries and for veneers or laminates covering the labial surface of a tooth on which there is no evidence of caries or a restoration.

Note: Missing teeth replaced by bridge pontics are coded 4 or 5 under coronal status, while root status is scored 9.

Implant. This code is used under root status to indicate that an implant has been placed as an abutment.

8 (–) *Unerupted crown.* This classification is restricted to permanent teeth and used only for a tooth space with an unerupted permanent tooth but without a primary tooth. Teeth scored as unerupted are

excluded from all calculations concerning dental caries. This category does not include congenitally missing teeth, or teeth lost as a result of trauma, etc. For differential diagnosis between missing and unerupted teeth, see code 5.

Unexposed root. This code indicates that the root surface is not exposed, i.e. there is no gingival recession beyond the CEJ.

T (T) *Trauma (fracture).* A crown is scored as fractured when some of its surface is missing as a result of trauma and there is no evidence of caries.

9 (–) *Not recorded.* This code is used for any erupted permanent tooth that cannot be examined for any reason (e.g. because of orthodontic bands, severe hypoplasia, etc.).

This code is used under root status to indicate either that the tooth has been extracted or that calculus is present to such an extent that a root examination is not possible.

Treatment needs of individual teeth. Countries vary greatly in the capacity of the dental profession to meet demands for oral health care and in professional attitudes and treatment techniques. There may therefore be wide variations in the findings of examiners from different areas, and even in the same area, on treatment needs. Examiners are encouraged to use their own clinical judgement when making decisions on what type of treatment would be most appropriate, based on what would be the probable treatment for the average person in the community or country. This could extend to scoring code "0" even though the dentition status has been given a different score.

Data on treatment needs are of great value at local and national levels because they provide a basis for estimating personnel requirements and costs of an oral health programme under prevailing or anticipated local conditions, provided that demand levels for those needs are taken into account.

Treatment requirements should be assessed for the whole tooth, including both coronal and root caries. Immediately after the status of a tooth is recorded, and before proceeding to the next tooth or tooth space, the type of treatment required, if any, should be recorded (boxes 98–113 and 146–161). If no treatment is required, code "0" should be placed in the appropriate treatment box. (If this is not done, it will be impossible to determine later, when the data are processed, whether no treatment was necessary, or whether the examiner or recorder omitted to make an appropriate entry.)

The codes and criteria for treatment needs are:

0 — *None* (no treatment). This code is recorded if a crown and a root are both sound, or if it is decided that a tooth should not receive any treatment.

P — *Preventive, caries-arresting care.*

F — *Fissure sealant.*

1 — *One surface filling.*

2 — *Two or more surface fillings.*

One of the codes P, F, 1 or 2 should be used to indicate the treatment required to:

— treat initial, primary or secondary caries;
— treat discoloration of a tooth, or a developmental defect;
— treat lesions due to trauma, abrasion, erosion or attrition;
— replace unsatisfactory fillings or sealants.

A sealant is considered unsatisfactory if partial loss has extended to exposure of a fissure, pit, or junction or surface of the dentine which, in the examiner's opinion, requires resealing.

A filling is considered unsatisfactory if one or more of the following conditions exist:

- *A deficient margin* to an existing restoration that has leaked or is likely to permit leakage into the dentine. The decision as to whether a margin is deficient should be based on the examiner's clinical judgement, on evidence gained from the insertion of a CPI probe at the margin, or on the presence of severe staining of the tooth structure.
- *An overhanging margin* of an existing restoration that causes obvious local irritation to the gingivae and cannot be removed by recontouring of the restoration.
- *A fracture of an existing restoration* that either causes it to be loose or permits leakage into the dentine.
- *Discoloration.*

3 — *Crown for any reason.*

4 — *Veneer or laminate* (may be recommended for aesthetic purposes).

5 — *Pulp care and restoration.* This code is used to indicate that a tooth probably needs pulp care prior to restoration with a filling or crown because of deep and extensive caries, or because of tooth mutilation or trauma.

Note: A probe should *never* be inserted into the depth of a cavity to confirm the presence of a suspected pulp exposure.

6 — *Extraction.* A tooth is recorded as "indicated for extraction", *depending on the treatment possibilities available*, when:

- caries has so destroyed the tooth that it cannot be restored;
- periodontal disease has progressed so far that the tooth is loose, painful or functionless and, in the clinical judgement of the examiner, cannot be restored to a functional state;
- a tooth needs to be extracted to make way for a prosthesis; or
- extraction is required for orthodontic or cosmetic reasons, or because of impaction.

7/8 — *Need for other care.* The examiner should specify the types of care for which codes 7 and 8 are used. The use of these two codes should be kept to a minimum.

9 — *Not recorded.*

Prosthetic status (boxes 162 and 163)

The presence of prostheses should be recorded for each jaw (box 162, upper jaw; box 163, lower jaw). The following codes are provided for this:

0 — *No prosthesis.*
1 — *Bridge.*
2 — *More than one bridge.*
3 — *Partial denture.*
4 — *Both bridge(s) and partial denture(s).*
5 — *Full removable denture.*
9 — *Not recorded.*

Prosthetic need (boxes 164 and 165)

A recording should be made for each jaw on the perceived need for prostheses (box 164, upper jaw; box 165, lower jaw), according to the following codes:

0 — *No prosthesis needed.*
1 — *Need for one-unit prosthesis* (one tooth replacement).
2 — *Need for multi-unit prosthesis* (more than one tooth replacement).
3 — *Need for a combination of one- and/or multi-unit prostheses.*
4 — *Need for full prosthesis* (replacement of all teeth).
9 — *Not recorded.*

Dentofacial anomalies (boxes 166–176)

Dental Aesthetic Index (DAI) criteria (*4*) are used. It is recommended that this index be used for age groups in which there are no longer primary teeth, usually from 12 years (see Annex 2). The codes and criteria are as follows.

Missing incisor, canine and premolar teeth (boxes 166 and 167). The number of *missing* permanent incisor, canine and premolar teeth in the upper and lower arches should be counted. This should be done by counting the teeth present, starting at the right second premolar and moving forward to the left second premolar. There should be 10 teeth present in each arch. If there are less than 10, the difference is the number missing. The number of missing teeth in the upper and lower arches should be recorded in boxes 166 and 167 of the assessment form (box 166, upper arch; box 167, lower arch). A history of all missing anterior teeth should be obtained to determine whether extractions were performed for aesthetic reasons. Teeth should not be recorded as missing if spaces are closed, if a primary tooth is still in position and its successor has not yet erupted, or if a missing incisor, canine or premolar tooth has been replaced by a fixed prosthesis.

Crowding in the incisal segments (box 168). Both the upper and the lower incisal segments should be examined for crowding. Crowding in the incisal segment is the condition in which the available space between the right and left canine teeth is insufficient to accommodate all four incisors in normal alignment. Teeth may be rotated or displaced out of alignment in the arch. Crowding in the incisal segments is recorded as follows:

0 — *No crowding.*
1 — *One segment crowded.*
2 — *Two segments crowded.*

If there is any doubt, the lower score should be assigned. Crowding should not be recorded if the four incisors are in proper alignment but either or both canines are displaced.

Spacing in the incisal segments (box 169). Both the upper and lower incisal segments should be examined for spacing. When measured in the incisal segment, spacing is the condition in which the amount of space available between the right and left canine teeth exceeds that required to accommodate all four incisors in normal alignment. If one or more incisor teeth have proximal surfaces without any interdental contact, the segment is recorded as having space. The space from a recently exfoliated primary tooth should not be recorded if it appears that the permanent replacement will soon erupt. Spacing in the incisal segments is recorded as follows:

0 — *No spacing.*
1 — *One segment spaced.*
2 — *Two segments spaced.*

If there is any doubt, the lower score should be assigned.

Diastema (box 170). A midline diastema is defined as the space, in millimetres, between the two permanent maxillary incisors at the normal position of the contact points. This measurement can be made at any level between the mesial surfaces of the central incisors and should be recorded to the nearest whole millimetre.

Largest anterior maxillary irregularity (box 171). Irregularities may be either rotations out of, or displacements from, normal alignment. The four incisors in the upper (maxillary) arch should be examined to locate the greatest irregularity. The site of the greatest irregularity between adjacent teeth is measured using the CPI probe (Fig. 5). The tip of the probe is placed in contact with the labial surface of the most lingually displaced or rotated incisor while the probe is held parallel to the occlusal plane and at right angles to the normal line of the arch. The irregularity in millimetres can then be estimated from the markings on the probe. It should be recorded to the nearest whole millimetre.

Irregularities may occur with or without crowding. If there is sufficient space for all four incisors in normal alignment but some are rotated or displaced, the largest irregularity is recorded as described above. The segment should not be recorded as crowded. Irregularities on the distal surface of the lateral incisors should also be considered, if present.

Largest anterior mandibular irregularity (box 172). The measurement is the same as on the upper arch except that it is made on the lower (mandibular) arch. The greatest irregularity between adjacent teeth on the lower arch is located and measured as described above.

Anterior maxillary overjet (box 173). Measurement of the horizontal relation of the incisors is made with the teeth in centric occlusion. The

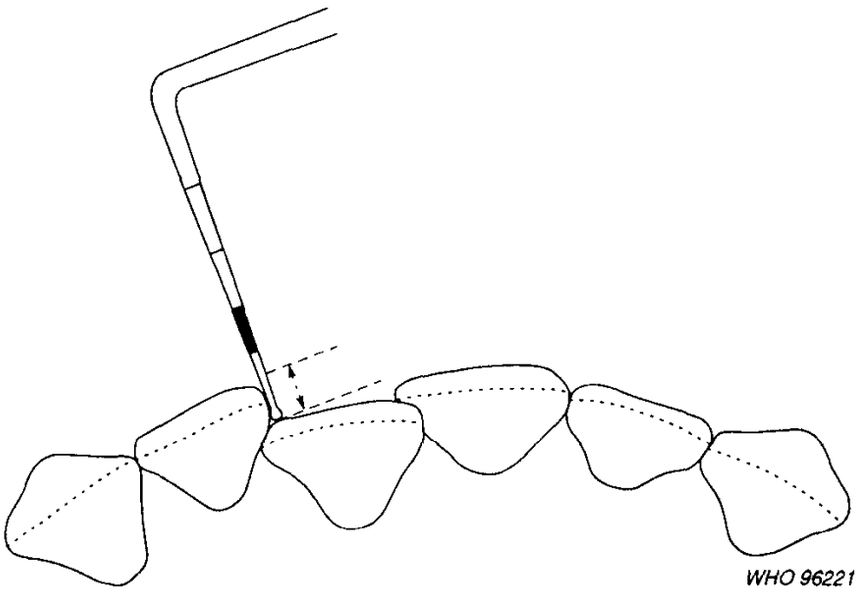


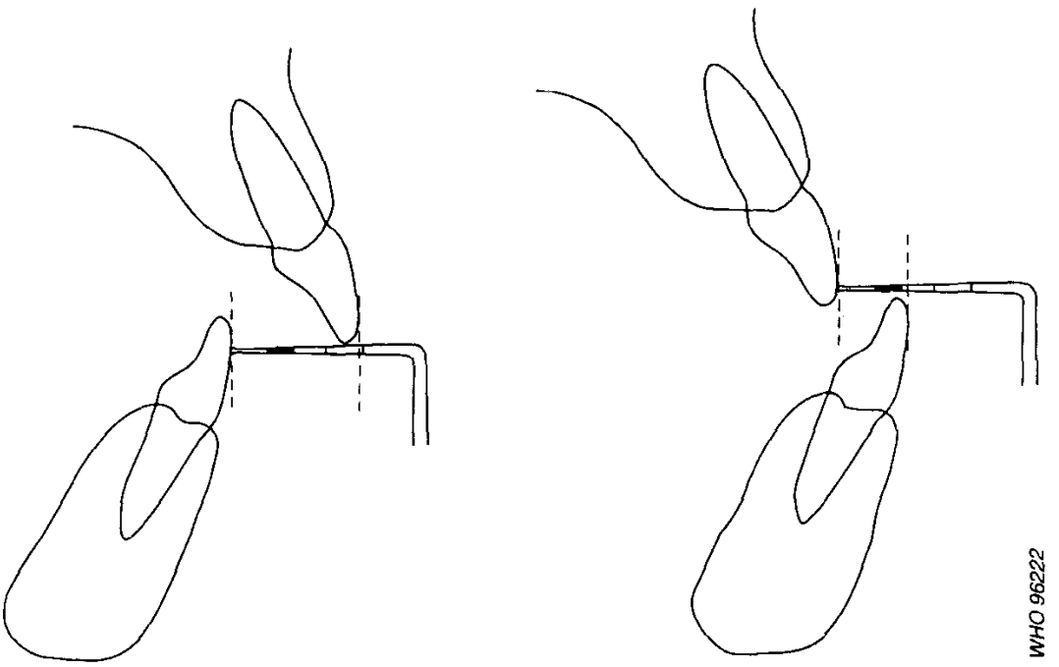
Fig. 5. Measuring anterior irregularities of the maxillary arch with a CPI probe

distance from the labial-incisal edge of the most prominent upper incisor to the labial surface of the corresponding lower incisor is measured with the CPI probe parallel to the occlusal plane (Fig. 6). The largest maxillary overjet is recorded to the nearest whole millimetre. Maxillary overjet should not be recorded if all the upper incisors are missing or in lingual crossbite. If the incisors occlude edge to edge, the score is zero.

Anterior mandibular overjet (box 174). Mandibular overjet is recorded when any lower incisor protrudes anteriorly or labially to the opposing upper incisor, i.e. is in crossbite. The largest mandibular overjet (mandibular protrusion), or crossbite, is recorded to the nearest whole millimetre. The measurement is the same as for anterior maxillary overjet (see Fig. 6). Mandibular overjet should not be recorded if a lower incisor is rotated so that one part of the incisal edge is in crossbite (i.e. is labial to the upper incisor) but another part of the incisal edge is not.

Vertical anterior openbite (box 175). If there is a lack of vertical overlap between any of the opposing pairs of incisors (openbite), the amount of openbite is estimated using a CPI probe. The largest openbite is recorded to the nearest whole millimetre (Fig. 7).

Antero–posterior molar relation (box 176). This assessment is most often based on the relation of the permanent upper and lower first molars. If the assessment cannot be based on the first molars because one or both are



Anterior maxillary overjet

Anterior mandibular overjet
(mandibular protrusion)

Fig. 6. Measuring anterior maxillary overjet and anterior mandibular overjet with a CPI probe

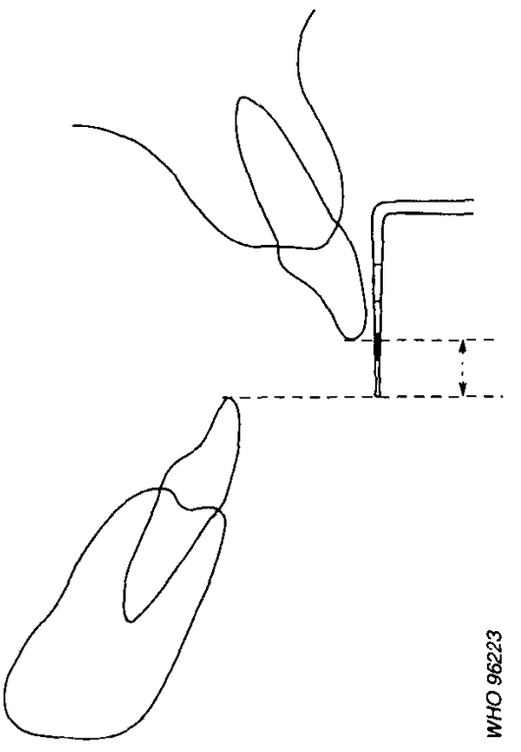


Fig. 7. Measuring vertical anterior openbite with a CPI probe

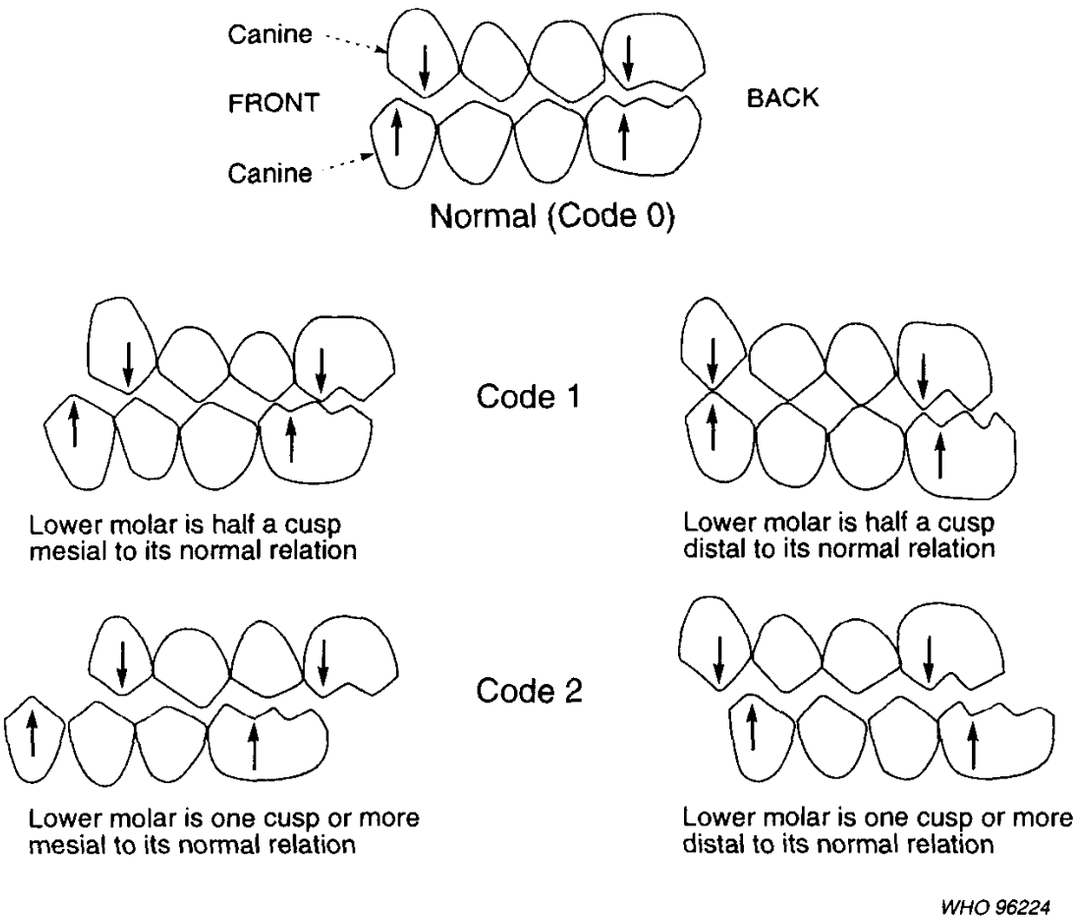

Canine
FRONT
Canine
BACK
Normal (Code 0)
Code 1
Lower molar is half a cusp mesial to its normal relation
Lower molar is half a cusp distal to its normal relation
Code 2
Lower molar is one cusp or more mesial to its normal relation
Lower molar is one cusp or more distal to its normal relation
WHO 96224

Fig. 8. Assessing the antero–posterior molar relation

absent, not fully erupted, or misshapen because of extensive decay or fillings, the relations of the permanent canines and premolars are assessed. The right and left sides are assessed with the teeth in occlusion and only the *largest* deviation from the normal molar relation is recorded (Fig. 8). The following codes are used:

0 — *Normal.*
1 — *Half cusp.* The lower first molar is half a cusp mesial or distal to its normal relation.
2 — *Full cusp.* The lower first molar is one cusp or more mesial or distal to its normal relation.

Need for immediate care and referral (boxes 177–180)

It is the responsibility of the examiner or team leader to ensure that referral to an appropriate care facility is made, if needed.

There is a need for immediate care if pain, infection or serious illness will result unless treatment is provided within a certain period of time. This period may vary from a few days to a month, depending on the availability of oral health services. Examples of conditions that require immediate attention include periapical abscess and acute necrotizing ulcerative gingivitis. Gross caries and chronic alveolar abscesses may also be recorded in box 178.

Three boxes are provided for the recording of the presence (code 1) of the following conditions:

— a life-threatening condition (oral cancer or precancerous lesions) or other severe condition with clear oral manifestation (box 177);
— pain or infection that needs immediate relief (box 178);
— other conditions, specify (box 179).

If the subject is referred for care, a "1" should be recorded in box 180.

The items coded in boxes 177–180 are not mutually exclusive; several recordings may be made when more than one condition requiring immediate attention is present.

Space is provided at the bottom of the assessment form for the examiner/recorder to note, for his or her own reference, any additional information that might be pertinent to the subject being examined.

6. Obtaining Assistance from WHO

Since WHO attaches great importance to basic oral health surveys, it is willing to offer assistance whenever possible, either directly or through one of its collaborating centres.

Pre-survey assistance

WHO is willing to assist with survey planning, in particular with advice on the sampling plan and use of the standard assessment form. The aims of such assistance are to foster the use of uniform survey methods and to help investigators develop objectives and survey plans to meet their specific needs. Prior to seeking assistance from WHO, investigators might find it helpful to discuss the survey and the proposed survey plan with experienced colleagues in the health or education sectors so that areas or factors of importance and interest are not neglected or overlooked. When seeking pre-survey assistance from WHO, investigators are requested to provide the following information:

- Name and address of the principal investigator.
- Area(s) and region(s) to be surveyed.
- Estimates of the total population, the number or percentage of the school-age population and the number or percentage of those who attend school.
- Estimates of the levels of caries, periodontal disease and other oral conditions for the ages under consideration (previous survey data should be provided if available).
- Important subgroups or divisions within the population, including the urban:rural population ratio, ethnic groups, socioeconomic levels.

Assistance in training and calibration may, under certain circumstances, be available from WHO. Subject to prior agreement, an experienced epidemiologist who has been trained in the recommended

methodology for basic oral health surveys may be appointed to attend the training and calibration sessions as a trainer and validating examiner.

Post-survey assistance

Subject to prior agreement, WHO is prepared to assist with the summary and analysis of data derived from the use of procedures recommended in this manual, provided that the standard format and coding have been used. The data should be entered onto a diskette using a standard data-entry program, which will be supplied by WHO. The analysis will be carried out using a standard computer program, which will produce a standard set of tables (see Annex 1). The summarized data will be systematically included in the WHO Global Oral Data Bank (GODB).

For those investigators who do not have access to computer facilities WHO may be able to arrange for assistance to be provided by a WHO collaborating centre, provided that a request is made before the survey is undertaken.

It should be noted that, even if WHO assists with the planning or analysis of the findings of a survey, it is the investigator's responsibility to obtain permission to conduct the survey from the responsible authorities. It is especially important that the investigator obtains local permission to carry out a survey in any country or locality of which he or she is not a national or local resident (see page 10).

WHO is continually trying to improve the basic methods for conducting oral health surveys. In this respect, it would be appreciated if investigators provide feedback on their experiences using these methods to Oral Health, World Health Organization, 1211 Geneva 27, Switzerland.

7. Post-Survey Action and Preparation of Survey Reports

Sending forms for analysis

It is strongly recommended that completed assessment forms be photocopied and stored separately as a safeguard against loss. Where photocopying facilities are not available, then carbon paper copies should be made at the time of examination.

At the end of each day of the survey, the principal investigator should ensure that all the forms are assembled in numerical order (by registration number) to facilitate checking. It is not necessary to sort the forms by location or age group, as this will be done by the computer.

When the data are to be analysed locally without assistance from WHO, the principal investigator should arrange for delivery of the forms to the appropriate computer centre. If reliable transport is available, completed forms may be packed and dispatched by post or carrier to the analysis centre at the end of each day's or week's work. In this way, the risk of losing all the survey data is greatly reduced. Parcels should be packed, fastened securely and clearly labelled so that forms are not lost, damaged or mixed up during transit.

If arrangements have been made for the data to be analysed by WHO, the data should be entered onto a diskette (see Chapter 6). The survey summary sheets (see Annex 3) should be completed in duplicate, one copy being retained by the investigator and the other included with the data diskette being dispatched for processing. Subject to prior agreement, WHO may be able to arrange for assistance with data processing to be provided by a WHO collaborating centre. In this case, the completed forms should be sent to WHO together with a copy of the survey summary sheet.

Preparation of survey reports

The report of the survey should usually contain the following information:

(a) Statement of the purposes of the survey

This statement should include a succinct and clear description of the aims of the survey and the expected ways in which the results will be used.

(b) Materials and methods

Under this heading, it is customary to include the following:

- *Area and population surveyed.* A general description of the geographical region and of the people examined is required.
- *The nature of the information collected and the methods used.* A description is required of the type of information collected and of the methods used to collect the data, e.g. questionnaire, interview or clinical examination. It is also essential to indicate the year of data collection. If reference is made to methods outlined in this manual, it is not necessary to describe the clinical examination in detail.
- *Sampling method.* An explanation should be given of the method of sampling that was used, the size of the total sample and subsamples, and the extent to which the sample is considered representative of the study population. The number and description of persons who were selected for the sample but not examined, and any sampling problems encountered should be reported.
- *Personnel and physical arrangements.* It is desirable to give a brief account of the physical arrangements at the examination sites, the equipment used, and the organization, training and experience of the personnel employed in collecting, processing and tabulating the data. Arrangements made for standardization and calibration of examiners and for checking the consistency of examiners during the course of the survey should be described.
- *Statistical analysis and computational procedure.* The statistical methods used in compiling the final summary tables from the raw data should be described briefly or references given. For example, reference can be made to methods described in this manual, where appropriate.
- *Cost analysis.* Information on survey expenses is of considerable interest. Reporting of costs of planning, calibration examinations, field work, supervision, statistical analysis, salaries and overheads facilitates the critical evaluation of survey methods and provides useful economic data.
- *Reliability and reproducibility of the results.* It is important to include data on inter-examiner and intra-examiner variability as revealed by pre-survey calibration examinations and duplicate examinations

conducted during the course of the survey. This information gives the planner for the area and the reader of the report an indication of the degree of examiner error that may apply to any of the results.

(c) Results

Results may be presented in several ways. Brevity is important. The text should contain a short description of the more important results and summary tables.

A few diagrams—graphs, histograms, bar-charts or pie-charts—may be used to illustrate points that are neither easily explained in the text, nor easily visualized from tables. A cardinal rule for both figures and tables is that they should be clearly labelled, so that they are readily comprehensible without reference to the text.

The basic summary tables provided by the WHO standard program address two main areas—oral health status and treatment needs of the population.

(d) Discussion and conclusions

The results of the survey should be discussed under two headings:

- The *oral health status* of the population should be compared with data from previous surveys of the same population; if such data are unavailable, comparison may be made with results of surveys in similar or neighbouring populations.
- *Treatment needs* of the population examined should be reported together with a brief discussion of the different treatment approaches possible, and of the implications of each approach for the future oral health status of the population.

(e) Summary or abstract

A brief summary of the report is required, of a suitable length for use as an abstract. The objectives of the study and the number of people examined should be stated and a few of the more important results given for caries and periodontal diseases in two or three age groups for the whole sample: for example, the proportion of subjects affected by caries and the proportion with bleeding and/or calculus and pocketing may be included. Any unusual or unexpected results obtained should be noted.

References

1. WHO Expert Group on Equipment and Materials for Oral Care (EGEMOC). *The periodontal probe for use with the community periodontal index of treatment needs (CPITN)*. Geneva, World Health Organization, 1990 (unpublished document WHO/ORH/EGEMOC/CPITN/1990; available on request from Oral Health, World Health Organization, 1211 Geneva 27, Switzerland).

2. FDI Commission on Oral Health, Research and Epidemiology. A review of the developmental defects of enamel index (DDE Index). *International dental journal*, 1992, 42: 411–426.

3. Dean HT. The investigation of physiological effects by the epidemiological method. In: Moulton FR, ed. *Fluoride and dental health*. Washington, DC, American Association for the Advancement of Science, 1942 (Publication No. 19): 23–31.

4. Cons NC, Jenny J, Kohout FJ. *DAI: the Dental Aesthetic Index*. Iowa, Iowa College of Dentistry, University of Iowa, 1986.

Annex 1

Tables prepared from survey data

The following descriptive tables can be produced by the WHO standard computer program from the data collected in a basic oral health survey. Results are given for the total sample and for each pertinent subgroup, as applicable. They are tabulated for single ages up to 19 years and thereafter by the following groupings: 20–24, 25–29, 30–34, 35–44, 45–54, 55–64, and 65 years and over. There is an option for use of a 5-year age group for those aged 15–19.

General information

Table 1: Distribution of total sample by age or age group.
Table 2: Distribution of total sample by ethnic group.
Table 3: Distribution of total sample by occupation.
Table 4: Distribution of total sample by geographical location.
Table 5: Distribution of total sample by type of location.
Table 6: Other data—number of subjects by code (boxes 29 and 30).
Table 7: Number and percentage of subjects with contraindications to examination.

Clinical assessment

Table 8: Number and percentage of subjects with normal extra-oral appearance; number and percentage of subjects with ulceration, sores, erosions or fissures, by site; number and percentage of subjects with cancrum oris, abnormalities of upper or lower lips, enlarged lymph nodes (head, neck), or other swellings of the face and jaws.
Table 9: Number and percentage of subjects with clicking, pain, or difficulties in opening or closing the jaw once or more per week.
Table 10: Number and percentage of subjects with clicking, tenderness (on palpation) or reduced jaw mobility (opening <30 mm).
Table 11: Number and percentage of subjects with healthy oral mucosa; number and percentage of subjects with malignant tumour

(oral cancer), leukoplakia, lichen planus, ulceration (aphthous, herpetic, traumatic), acute necrotizing gingivitis, candidiasis, abscess, or other condition.

Table 12: Number and percentage of subjects with malignant tumour (oral cancer), leukoplakia, lichen planus, ulceration (aphthous, herpetic, traumatic), acute necrotizing gingivitis, candidiasis, abscess, or other condition, by location.

Table 13: Tabulation of oral mucosal conditions, by location.

Table 14: Number and percentage of subjects with enamel opacities or hypoplasia, by condition and by number of teeth affected.

Table 15: Number and percentage of subjects with dental fluorosis, by level of severity.

Table 16: Percentage of subjects with healthy periodontal tissues; percentage of subjects with bleeding only; percentage of subjects with calculus; percentage of subjects with shallow pockets (4–5 mm); percentage of subjects with deep pockets ($\geqslant$6 mm).

Table 17: Mean number of sextants with healthy periodontal tissues, bleeding or higher score, calculus or higher score, shallow pockets or higher score, deep pockets, and mean number of sextants excluded from examination.

Table 18: Number and percentage of subjects with loss of attachment, by highest score.

Table 19: Mean number of sextants with loss of attachment, by score; mean number of sextants excluded from examination; mean number of sextants not recorded.

Table 20: Number and percentage of subjects with and without natural teeth.

Table 21: Mean number of primary teeth present per person.

Table 22: Number and percentage of subjects with caries of the primary dentition; number and percentage of subjects with untreated caries of the primary teeth; number and percentage of subjects with four or more dmf[1] primary teeth.

Table 23: Mean number of decayed primary teeth per person; mean number of filled primary teeth with decay per person; mean number of filled primary teeth per person; mean number of missing primary teeth per person; mean number of dmf primary teeth per person.

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[1] dmf = decayed, missing and filled primary teeth.

Table 24: Mean number of permanent teeth per person.
Table 25: Number and percentage of subjects who have or have had caries of the permanent dentition; number and percentage of subjects with untreated caries; number and percentage of subjects with four or more DMF[1] permanent teeth.
Table 26: Mean number of decayed permanent teeth per person; mean number of filled permanent teeth with decay per person; mean number of filled permanent teeth per person; mean number of missing permanent teeth per person; mean number of DMF permanent teeth per person.
Table 27: Number and percentage of subjects with root caries.
Table 28: Mean number of teeth per person with root caries.
Table 29: Number and percentage of subjects with coronal and/or root caries.
Table 30: Mean number of teeth per person with coronal and/or root caries.
Table 31: Number and percentage of subjects requiring preventive or caries-arresting care, sealant, surface filling(s), crown, veneer or laminate, pulp care and restoration, extraction, or other treatment.
Table 32: Mean number of teeth per subject requiring preventive or caries-arresting care, sealant, surface filling(s), crown, veneer or laminate, pulp care and restoration, extraction, or other treatment.
Table 33: Number and percentage of subjects with prostheses, by type of prosthesis and by jaw.
Table 34: Number and percentage of subjects requiring prostheses, by type of prosthesis and by jaw.
Table 35: Percentage of subjects with missing incisors, canines and premolars.
Table 36: Percentage of subjects with crowding, spacing, diastema, or anterior maxillary or mandibular irregularities.
Table 37: Percentage of subjects with anterior maxillary overjet, anterior mandibular overjet, vertical anterior openbite, or antero–posterior molar relation.
Table 38: Percentage of subjects with dentofacial anomalies, by level of severity.

[1]DMF = decayed, missing and filled permanent teeth.

Annex 2
Explanation of statistical calculations and guidelines for data analysis

Assessment of reproducibility

Inter- and intra-examiner consistency can be assessed in a number of ways, the simplest being the percentage of agreement between scores, e.g. the percentage of subjects allocated the same score by two examiners. However, in the case of caries, if the prevalence of disease is low, this method does not give an accurate measure of reproducibility. A more reliable way of assessing overall agreement between examiners is the kappa statistic (*1*). The kappa statistic relates the actual measure of agreement with the degree of agreement which would have occurred by chance. The kappa score can be calculated from the table below.

Examiner 2	Examiner 1		
	Sound	Carious	Total
Sound	a	c	a + c
Carious	b	d	b + d
Total	a + b	c + d	a + b + c + d (= 1)

a = The proportion of teeth both examiners agree to be sound.
b = The proportion of teeth examiner 1 considers to be sound and examiner 2 considers to be carious.
c = The proportion of teeth examiner 1 considers to be carious and examiner 2 considers to be sound.
d = The proportion of teeth both examiners consider to be carious.

The formula is:

$$\varkappa = \frac{P_o - P_e}{1 - P_e}$$

where:

P_o = the proportion of observed agreement, i.e. (a + d);

P_e = the proportion of agreement that could be expected by chance, i.e. (a + c) × (a + b) for sound teeth and (b + d) × (c + d) for carious teeth.

Hence

$$P_e = \frac{(a + c) \times (a + b) + (b + d) \times (c + d)}{(a + b + c + d)^2} \qquad (2).$$

When there is total agreement, $\varkappa = 1$. When there is total disagreement, i.e. a + d = 0, then $\varkappa = 0$. A score of >0.8 indicates good agreement, 0.6–0.8 substantial agreement and 0.4–0.6 moderate agreement (*3*).

Decayed, Missing and Filled Teeth Index (DMFT)

Information on the Decayed, Missing and Filled Teeth Index (DMFT) can be calculated from the information in boxes 66–97 and 114–145. The D-component includes all teeth with codes 1 or 2. The M-component comprises teeth coded 4 in subjects under 30 years of age, and teeth coded 4 or 5 for subjects 30 years and older, i.e. missing due to caries or for any other reason. The F-component includes only teeth with code 3. The basis for DMFT calculations is 32, i.e. all permanent teeth including wisdom teeth. Teeth coded 6 (fissure sealant) or 7 (bridge abutment, special crown or veneer/implant) are not included in calculations of the DMFT.

Analysis of data collected under dentofacial anomalies

The collection of data according to Dental Aesthetic Index (DAI) criteria permits analysis to be made of each of the separate components of the index or grouped under anomalies of dentition, space and occlusion. It is also possible to calculate standard DAI scores using the DAI regression equation whereby the measured components of the DAI are multiplied by their regression coefficients, the products then being added to the regression equation constant. The resultant sum is the standard DAI score (*4*).

The regression equation used for calculating standard DAI scores is as follows:[1]

(missing visible teeth × 6) + (crowding) + (spacing) + (diastema × 3) + (largest anterior maxillary irregularity) + (largest anterior mandibular irregularity) + (anterior maxillary overjet × 2) + (anterior mandibular overjet × 4) + (vertical anterior openbite × 4) + (antero–posterior molar relation × 3) + 13

The severity of malocclusion within a population is classified on the basis of the DAI scores as shown in the table overleaf.

[1] *Note*: The regression coefficients have been rounded to the nearest whole number.

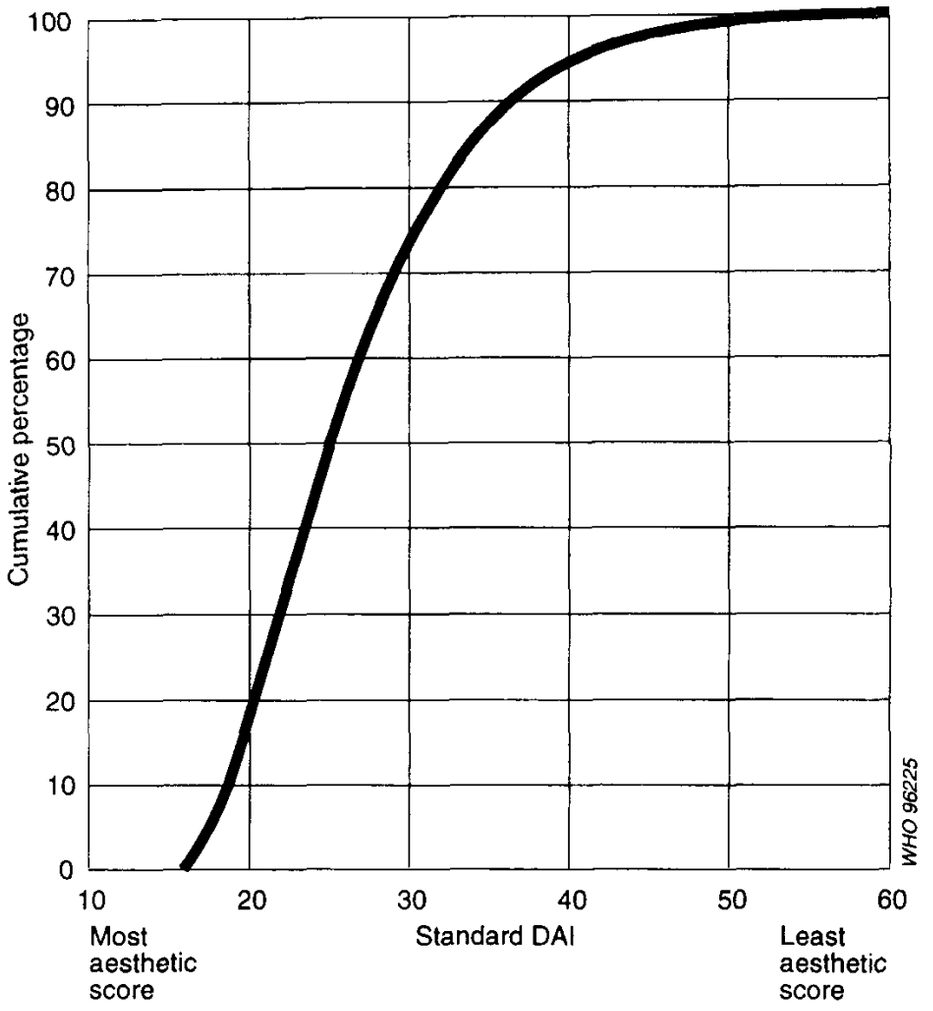

Fig. A1. Distribution of standard DAI scores (Source: reference *4*. Used by permission.)

Severity of malocclusion	Treatment indication[a]	DAI score
No abnormality or minor malocclusion	No or slight need	<25
Definite malocclusion	Elective	26–30
Severe malocclusion	Highly desirable	31–35
Very severe or handicapping malocclusion	Mandatory	⩾36

[a] These treatment indications should serve only as a guide. Health administrators may determine priority for treatment by plotting a distribution of standard DAI scores according to their cumulative percentages in a population (Fig. A1). The decision points used to determine treatment indications can then be modified according to local conditions and available resources.

References

1. Cohen JA. Coefficient of agreement for nominal scales. *Educational and psychological measurement*, 1960, 20: 37–46.
2. Bulman JS, Osborne JF. Measuring diagnostic consistency. *British dental journal*, 1989, 166: 377–381.
3. Landis JR, Kock GG. The measurement of observer agreement for categorical data. *Biometrics*, 1977, 33: 159–174.
4. Cons NC, Jenny J, Kohout FJ. *DAI: the Dental Aesthetic Index*. Iowa City, IA, Iowa College of Dentistry, University of Iowa, 1986.

Annex 3

Survey summary based on WHO Oral Health Assessment Form (1997)

Country: .....
Dates of survey (month(s)/year): .....
Principal investigator: .....
Address: .....
.....
.....

Identification numbers used:
from: ..... to: .....
from: ..... to: .....
from: ..... to: .....
Age(s)/age groups examined: .....

Examiner code (box 15)	Ethnic group code (box 24)	Occupation code (box 25)
1	0	0
2	1	1
3	2	2
4	3	3
5	4	4
6	5	5
7	6	6
8	7	7
9	8	8

Geographical location code (boxes 26 and 27)	Other data (box 29)	Other data (box 30)
00	0	0
01	1	1
02	2	2
03	3	3
04	4	4
05	5	5
06	6	6
07	7	7
08	8	8
09		

(if more than 10, continue overleaf)

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Images have been losslessly embedded. Information about the original file can be found in PDF attachments. Some stats (more in the PDF attachments):

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